

**INFANTILE MORTALITY
AND
INFANTS MILK DEPOTS**

G. F. M^c CLEARY



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INFANTILE MORTALITY

AND

INFANTS MILK DEPOTS.



"L'ŒUVRE DE LA GOUTTE DE LAIT" (Dr. Variot's consultation at the Belleville Dispensary, Paris).

From the painting by M. Jean Geoffroy, exhibited in the Salon in 1903, now the property of the Municipality of Paris.

This picture illustrates the three main features of the work of the Goutte de Lait: (1) weighing the babies, (2) medical consultation, (3) distribution of sterilized milk.

INFANTILE MORTALITY AND INFANTS MILK DEPÔTS

BY

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of Battersea*

London:

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1905

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TO

DR. LÉON DUFOUR,

FOUNDER OF THE "GOUTTE DE LAIT,"

FÉCAMP.

PREFACE.

IN the year 1899 the St. Helens Town Council, acting on the advice of Dr. Drew Harris, the Medical Officer of Health, appointed a Committee to visit Fécamp and report upon the work of an institution which had been established in that town in 1894 by Dr. Léon Dufour, as an attempt to prevent the heavy infantile mortality dependent upon improper infantile feeding. To this institution Dr. Dufour had given the name of "Goutte de Lait." The result of the Committee's visit and report was that in 1899 a municipal dépôt was established in St. Helens for the supply, under special conditions, of specially-prepared infants milk. This dépôt resembled the Fécamp "Goutte de Lait" in certain particulars, but, as will appear in the following pages, by no means in all. Similar dépôts have been established since in other towns in England and

Scotland, and it seems probable that their number will soon be much increased.

In this book an attempt is made to give some account of the history and practical working of these depôts, of the objects for which they were established, and of the results which they have secured. This involved some consideration of the closely-related subjects of infant feeding and infantile mortality; and in order to emphasize the importance of the prevention of infantile mortality a chapter has been added on the decline of the English birth-rate.

Portions of Chapters IV.—VIII. have appeared already in the *Journal of Hygiene*, together with the frontispiece and Plates XI., XVI., XVIII., XIX., XXI., and the writer is indebted to the editor of that journal for permission to reproduce these chapters in their present form, and for the use of the blocks of the illustrations. The writer is also indebted to the editor of the *World's Work* for the use of the blocks of Plates XII., XIV., XV., XVII., which originally appeared in that magazine.

The writer's thanks are due to the many

correspondents at home and abroad who have kindly supplied him with information and photographs. For the photographs of the Liverpool dépôt he is indebted to Dr. Hope, for those of the institutions at Brussels, Hodimont, Madrid, Rochester, and York he is indebted to Dr. Lust, M. Jules Cerexhe, Dr. Ulecia Y Cardona, Dr. George W. Goler, and Mr. Seebohm Rowntree respectively. The blocks of the Fécamp illustrations were kindly supplied by Dr. Dufour, together with much valuable information. Plates I., II. are from the valuable collection of photographs of Danish agricultural conditions which Dr. F. Lawson Dodd kindly placed at the writer's disposal.

BATTERSEA, *February*, 1905.

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INFANTILE MORTALITY AND INFANTS MILK DEPÔTS.

CHAPTER I.

THE DECLINE IN THE ENGLISH BIRTH-RATE.

DURING the greater part of the last century the fear of over-population was a fruitful source of pessimism to political economists. "The spectre of Malthusianism," to use Professor Marshall's phrase, "cast a gloom over economic speculation." It certainly haunted the mind of John Stuart Mill, and appears in chapter after chapter of his "Political Economy." Nor were the disciples of Malthus to be found only amongst serious students of social phenomena. The doctrine of the fatal tendency of the population to outgrow the means of subsistence was preached from the pulpits of economic orthodoxy with such effect that it became a popular possession, and it was widely held that in order to secure a lasting improvement in the condition of the poorer classes it was before

all things necessary to stem "the devastating torrent of babies."

At the present time the population problem presents another aspect, and there are signs that the real danger is not over-population, but de-population. During the last thirty years there has been a remarkable decline in natality in this country, and there is reason to think that there will be a further decline in the future. From the following table it will be seen that the English birth-rate, which in the quinquennia before the seventies had maintained a high level, has since that period undergone a steady and continuous decline.

BIRTH-RATES PER 1,000 POPULATION AT ALL AGES IN
ENGLAND AND WALES.

Periods.	Birth-rate.	Periods.	Birth-rate.
1851—1855	33'9	1881—1885	33'5
1856—1860	34'4	1886—1890	31'4
1861—1865	35'2	1891—1895	30'5
1866—1870	35'3	1896—1900	29'3
1871—1875	35'5	1901—1903	28'5
1876—1880	35'4	1904	27'9

It may be objected that the "birth rate," *i.e.*, the proportion of births per 1,000 of the total population, is not altogether a trustworthy measure

of natality, as it varies in significance with the age-constitution of the population. If, however, we adopt the more accurate method of calculating the proportion of legitimate births per 1,000 married women at child-bearing ages and the proportion of illegitimate births per 1,000 unmarried women at the same age periods, we obtain much the same result, as appears from the following figures, which have been calculated from the census returns and from the annual reports of the Registrar General.¹

Year.	Legitimate Births per 1,000 Married Women, aged 15—45.	Illegitimate Births per 1,000 Un- married Women, aged 15—45.
1871	289·3	16·9
1881	285·6	14·1
1891	269·8	10·6
1901	234·9	8·3

¹ In the *Fortnightly Review* for March, 1902, Mr. Edwin Cannan suggests that "a rough measure of changes in natality may be obtained by comparing the number of births in each year with the number of persons reaching something like the average age of marriages in that year," the latter being proportionate, mortality and migration remaining the same, to the number of persons born a certain number of years before. Adopting this method, he finds that the number of births per 100 of the births which were registered 26 years earlier has fallen from 144 in 1877 to 108 in 1900. He also calculates that the number of children per marriage has fallen in the same period from 4·30 to 3·63.

These figures show a marked decrease in the fecundity of marriages since 1881, and a still more marked decrease in the illegitimate birth-rate. The effect of the latter, however, on the total natality is comparatively slight, and is to some extent due to the fact that the population upon which it is based has considerably increased owing to the increase in the proportion of unmarried women in the female population at child-bearing ages. This is shown in the following table from the Census Report of 1901:—

OF 1,000 MALES AND 1,000 FEMALES IN EACH AGE GROUP FROM 15 TO 65 YEARS, THE PROPORTION RETURNED AS MARRIED.

Age.	Sex.	1871.	1881.	1891.	1901.
15—20	Males ...	5	5	4	3
	Females...	32	25	19	15
20—25	Males ...	230	221	193	173
	Females...	343	331	296	272
25—35	Males ...	668	669	645	631
	Females...	676	681	653	643
35—45	Males ...	826	826	819	812
	Females...	762	765	761	751
45—55	Males ...	832	849	827	819
	Females...	717	711	706	705
55—65	Males ...	771	779	771	764
	Females...	589	581	573	569

From the foregoing figures it appears that the decline in English natality has been brought about by a decrease (1) in the fecundity of marriages; (2) in the proportion of married persons at fertile ages; (3) in illegitimacy.

Of these, the first has had much the greatest effect, while the decline in illegitimacy (which, of course, cannot be regarded as other than satisfactory) has had the least. Each of these factors requires separate consideration, and a far more searching analysis than can be attempted in these pages. It may be said, however, that it is difficult to suggest any cause for our declining natality that may be expected to operate with less force in the future than it has done in the past, and there is little doubt that we are rapidly approaching a period when, apart from immigration, the population of this country will have become stationary, or have begun to diminish.¹

Mr. H. G. Wells has attempted to minimise the significance of the decline in the English birth-rate. In "Mankind in the Making," pp. 88—90, he points out that although the birth-rate has fallen, the death-rate has also fallen, and that therefore the excess of births over deaths is much the same now as it was 50 years ago. Hence the fall of the birth-rate is of no importance. The validity of this argument depends upon the implied assumption that the death-rate can be reduced to zero—a difficult achievement even for the New Republicans of Mr. Wells' Utopia. The lower death-rates of recent years are partly explained by the fact that the declining birth-rate has diminished the proportion of children (whose mortality is high) in the population and increased the proportion of persons at ages of low mortality. When these persons pass middle life and enter the age periods of high mortality the death-rate

It has been argued that this country already contains as large a population as it can hold comfortably, and any considerable increase is to be deplored rather than encouraged. If England were a self-contained country much could be said from this point of view. But England is now regarded as the nucleus of a great Empire, with colonies which, though vast in extent, are poor in population, and the fact must be faced that in view of our declining natality, the stream of emigrants that formerly left our shores cannot be expected to continue. If the colonies are to be peopled with men and women of British blood

will rise unless checked by extensive hygienic reforms. But when we remember that in a normal stationary population a death-rate of 10 per 1,000 implies a mean age at death of 100 years, it is clear that the English death-rate cannot be expected to be maintained much below the rate in 1903, viz., 15·4. In France, where the birth-rate has been low for many years, the proportion of elderly persons is high, and the death-rate is over 20 per 1,000. A birth-rate, however, is governed by different conditions; not only can it go down to zero, but this must actually have happened to the extinct races, and some modern communities appear to be making good progress in the same direction. According to M. Arsène Dumont (*"Natalité et Démocratie"*) the birth-rate in the department of the Orne for the decade 1883—1892 was 8·7 per 1,000 population! Mr. Wells attaches importance to the decline in the illegitimate birth-rate, which he accepts as evidence that we are becoming "not only more hygienic and rational, but more moral and temperate." It would be pleasant to share this optimism; but it is probable that the decline in illegitimacy is to be attributed less to improved morals than to increased knowledge accompanying the increasing urbanization of the population. The causes of the declining fecundity of marriages have probably been operative also in the decrease of illegitimacy.

they must depend on their own fertility, and not on that of the old country.

When, however, we examine the vital statistics of our more important colonies, we find a decline in natality greater even than that in this country. In the Australian colonies, which may be considered as forming a type to which, in some respects, other British communities tend to approximate, the birth-rate has declined so rapidly as to cause considerable anxiety. In 1903, the Government of New South Wales appointed a Royal Commission to inquire into the decline of the birth-rate in that colony. The report of this Commission, issued in March, 1904, contains an immense mass of information bearing on questions of natality, and should be read, together with Mr. Coghlan's essay¹ on the same subject, by all students of this most important question. These documents show not only that there has been a marked decline in natality in the Australian States, but also that there are good reasons for concluding that the decline is far from having reached its lowest point. The decline in the birth-rate is shown in the following table.²

¹ Coghlan, "The Decline in the Birth-rate in New South Wales," Sydney, 1903.

² "Report of the Royal Commission on the Decline of the Birth-rate and on the Mortality of Infants in New South Wales," 1904.

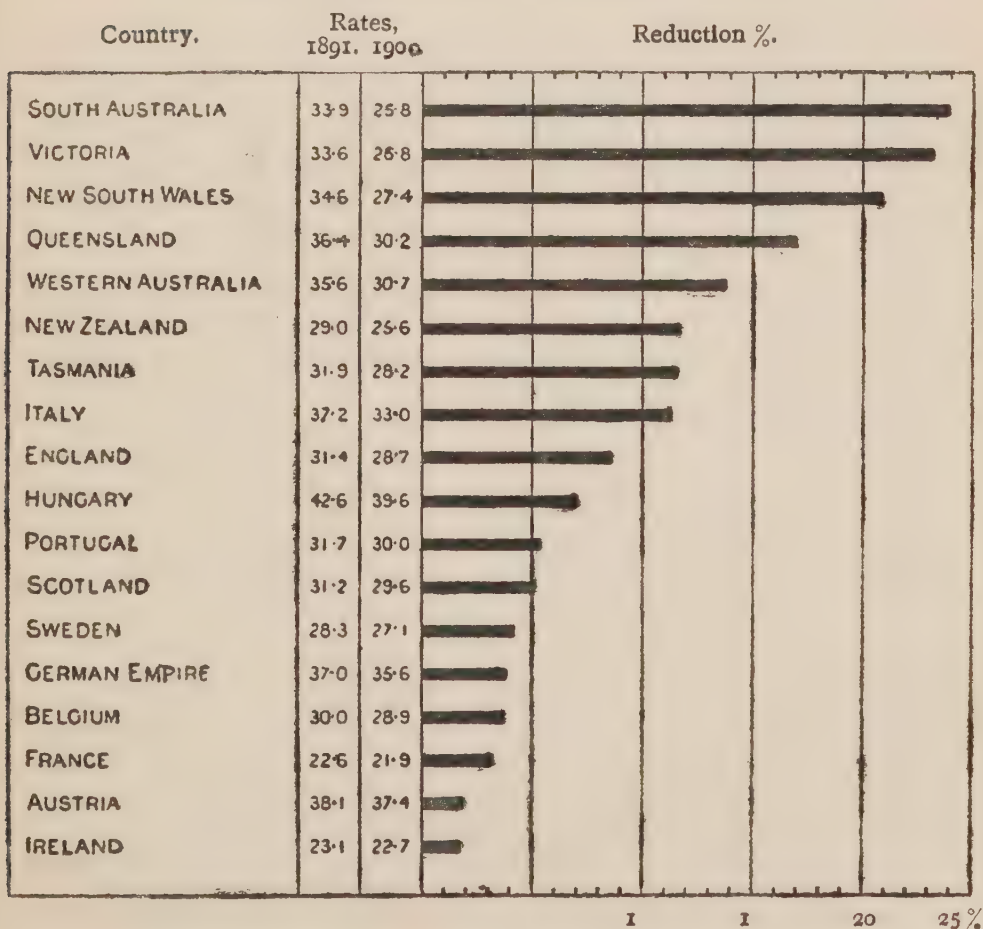
BIRTH-RATE PER 1,000 POPULATION.

Year.	New South Wales.	Victoria.	Queensland.	S. Australia.	W. Australia.	Tasmania.	New Zealand.
1871—1875	39·05	35·69	40·81	37·24	31·30	29·72	40·02
1876—1880	38·53	31·43	36·72	38·28	32·97	31·54	41·32
1881—1885	37·65	30·76	36·37	38·52	34·57	35·02	36·50
1886—1890	36·36	32·72	38·81	34·48	36·88	34·59	31·22
1891—1895	32·93	30·93	35·15	31·54	30·77	32·84	27·66
1895—1900	27·98	26·22	30·40	26·59	28·73	28·28	25·74

The following diagram shows the percentage reduction in the birth-rates of various countries during the decennium 1891—1900. The greatest reductions have taken place in the Australian colonies. This diagram is taken from the New South Wales Government Report on the declining birth-rate.

BIRTH-RATES PER 1,000 OF POPULATION-COUNTRIES OF THE WORLD.

Reduction per cent. in 10 years in Rate.



The decline of the Australian birth-rate is one of the most remarkable of modern sociological phenomena. That a young and vigorous people, living in an immense and undeveloped country, and oppressed by no burdens of militarism, should voluntarily limit their natality is an event so striking as to call for the deepest attention and study. The significance of the phenomenon to Australia is well expressed in the concluding portions of the Report of the New South Wales Commission :—

“From time to time in recent years, public men seeing in the establishment of the Australian Commonwealth the first step in the construction of a great nation, and anticipating therefrom a rapid increase of national prosperity and progress, have referred hopefully to the day when Australia with her teeming millions will hold a commanding place among the peoples of the world. The patriotic ardour inspired by this hopeful anticipation is, however, destined to be cooled in the contemplation of the fact that, while Russia and Japan, prospective rivals of Australia for supremacy in the Western Pacific, are already seeking outlets beyond their own borders for the energies of their ever-growing people, it will be forty-six and a half years before Australia, with her three and three-quarter millions of inhabitants, and dependent alone on her natural increase (if this even be maintained at its present rate), will have doubled her population; 113 years before she will have twenty millions of people; and 168 years before her numbers will have reached the present population of Japan. In whatever way the waning birth-rate of New South Wales is viewed . . . it is seen as a grave disorder, sapping the vitals of a new people, dispelling its

hopes, blighting its prospects, and threatening its continuance.”¹

The Canadian vital statistics are much less complete than the Australian, but there is little doubt that the natality of the inhabitants of British origin is remarkably low. In Ontario, where our stock predominates, the birth-rate in 1901 was only 21·1, while in the province of Quebec, which is chiefly French-Canadian, the rate was 35. In the 35 counties of the latter province, whose population is almost exclusively French-Canadian, the mean birth-rate in 1902 was 42·2, and in the following counties the birth-rate indicates an extraordinary exercise of reproductive power:—Beauce, 53·2, Bellechasse, 49·3, Champlain, 49·1, Charlevoix, 65·6, Rimonski, 48·8.² In the official vital statistics of the city of Montreal the population is distributed into three classes, viz., French-Canadians, other Catholics and Protestants, and in 1902 the birth-rate of each class was as follows :³—

French-Canadians	...	43·5
Other Catholics	...	22·4
Protestants	...	23·7

¹ “Report of the Royal Commission on the Decline of the Birth-rate and on the Mortality of Infants in New South Wales.”

² “Annual Report of the Board of Health of the Province of Quebec,” 1902—1903.

³ “Annual Report of the Medical Officer of Health of the City of Montreal,” 1902.

In South Africa vital statistics are also incomplete, but there is evidence that the British element is comparatively infertile.

It would appear, then, that all over the Empire our race is becoming less and less fertile, and although only the future can show whether this decline in fertility can be arrested, it cannot be said at the present time that the prospect is hopeful.

Declining fertility associated with a high civilisation is nothing new in the world's history. Depopulation by sterility is given by Thirlwall as one of the most important of the causes that destroyed the power of the Greeks,¹ and according

¹ Thirlwall, "History of Greece." According to Thirlwall, the decline of population in Greece was not due to Roman misrule, but had been going on for many generations before. He quotes Polybius as to the cause of the decline: "In our times all Greece has been afflicted with a failure of offspring, in a word with a scarcity of men; so that the cities have been left desolate and the land waste; though we have not been visited either with a series of wars or with epidemic diseases. Would it not be absurd to send to inquire of the oracles by what means our numbers may be increased, and our cities become more flourishing, when the cause is manifest, and the remedy rests with ourselves? For when men gave themselves up to ease, and comfort, and indolence, and would neither marry, nor rear children born out of marriage, or at most only one or two, in order to leave these rich, and to bring them up in luxury, the evil soon spread, imperceptibly, but with rapid growth; for when there was only a child or two in a family for war or disease to carry off, the inevitable consequence was that houses were left desolate, and cities by degrees became like deserted hives, and there is no need to consult the gods about the mode of deliverance for this evil: for any man would tell us, that the first thing we have to do is to change our habits, or at all events to enact laws compelling parents to rear their children."

to the historian of our own Empire, it was sterility that brought about the decay of Rome.

“Barbarians might enter freely and take possession. Vandal corsairs from Carthage might outdo the work of Hannibal, and Germany avenge at her leisure the invasions of Cæsar and Drusus, for the invincible power had been tamed by a slow disease. Rome had stopped from a misgiving she could not explain to herself in the career of victory. A century of repose had left her weaker than before. She was able to conquer her nationalities. She had centralised herself successfully and created a government of mighty efficiency and stability. But against this disease she was powerless, and the disease was sterility.” “Men were wanting; the Empire perished for want of men.”¹

There is reason to fear that the disease which destroyed the Roman Empire has attacked our own race, in our own country, and in the dominions beyond the seas.

¹ J. R. Seeley, “Roman Imperialism: Lectures and Essays.”

CHAPTER II.

INFANTILE MORTALITY.

IN the previous chapter we have seen that during the last few decades there has been a remarkable falling off in the fertility of our race, not only in this country, but also in most of the colonies, and that there are reasons for thinking that the downward movement is far from having reached its lowest point. It is important, therefore, that the effect of our declining fertility should be neutralised as far as possible by a substantial reduction in mortality, and there is no doubt that to this consideration must be ascribed much of the growing interest in the prevention of infantile mortality in this country and in Australia. But other influences have contributed to bring the problems of infantile mortality into greater prominence during recent years. The growing humanitarianism of the age becomes more and more intolerant of the terrible ravages of preventable disease which year by year recur amongst the children of our urban centres, and calls for increased preventive action. The continuance of a high rate of infantile mortality is, indeed, a serious blot on the splendid record of English

preventive medicine. It is a striking fact that while the general death-rate has steadily declined in this country during recent years, the rate of infantile mortality, since the eighties, has shown a tendency to increase.

This is shown in the following table :¹—

Years.	Death-rate per 1,000 Population.	Deaths under One Year per 1,000 Births.
1851—1855	22·6	156
1856—1860	21·8	151
1861—1865	22·5	151
1866—1870	22·4	156
1871—1875	21·9	153
1876—1880	20·8	144
1881—1885	19·4	138
1886—1890	18·8	145
1891—1895	18·7	150
1896—1900	17·6	156
1901	16·9	151
1902	16·3	133
1903	15·4	132
1904	16·2	146

It would seem either that the practical measures of preventive medicine, to which we must attribute much of the decline in the general death-rate, have been without effect on children under one year, or that their effect has been neutralised by the increased action of agencies specially inimical to infant life. In either case, it appears that what is wanted is not so much further progress on the

¹ The comparatively low rates of infantile mortality in 1902—1903 are explained by the exceptional meteorological conditions during the summers of those years.

old lines as the adoption of methods more directly aimed to safeguard the youngest and most helpless members of the community. Many such methods have been proposed, and some—such as the public supply of infants milk, which is the subject of this book—have been to some extent adopted; but before we begin to consider any of these methods, it will be useful to take a brief survey of the various conditions which give rise to infantile mortality.

The causes of infantile mortality may be classified in the following way:—(1) Hereditary influences acting through the germ cells of the parents; and (2) adverse environmental conditions affecting the child (*a*) before birth (intra-uterine conditions); and (*b*) after birth (post-natal conditions). Each of these requires separate consideration.

The influence of heredity upon disease has formed the subject of many works of fiction and of fact, and there is probably no subject upon which so much has been written to so little purpose. Although our ignorance of the subject is great, there is little doubt that the influence of heredity in this connection has been exaggerated, and there is now, fortunately, an increasing disinclination to seek to explain morbid processes by assuming that they “run in the family,” or are due to “inherited diatheses.” Nevertheless, it must be admitted that heredity does play a part in the production of disease, and, although the

actual transmission of a virus from parent to child is a comparatively infrequent event, there are reasons for thinking that the child may inherit a tendency to morbid tissue changes, or a lack of resisting power to enemies from without, which will sooner or later lead to the production of those groups of morbid symptoms and processes which are called "diseases." But to what extent such influences are operative in the causation of infantile mortality it is impossible to say, and in the absence of more definite knowledge it is difficult to take effective preventive action.

The importance of the conditions affecting the child during the period of gestation has received hitherto very inadequate recognition. It has been asserted, in fact, that the unborn child is so well able to take care of himself that we may wait with perfect confidence until he is born before we need concern ourselves in his welfare. Several witnesses before the Committee on Physical Deterioration gave evidence to the effect that by virtue of some hypothetical "mysterious law of transmitted impulse the unborn child fights strenuously for its own health at the expense of the mother, and arrives in the world with a full chance of living a normal physical existence."¹ This opinion has received a wide circulation, and has been hailed in one of the lay journals as "worth many volumes of evidence of

¹ Report of the Inter-Departmental Committee on Physical Deterioration, page 46.

religion which have descended to us from the eighteenth century." It seems worth while, therefore, to point out that the witnesses who gave utterance to this statement supported it by no evidence beyond expressions of opinion, and that such real evidence as exists on this difficult subject tells strongly in favour of the opposite view, the view suggested by common sense, namely, that the nutrition and mode of life of the mother during pregnancy have a considerable influence on the child before birth. Dr. Prochownick has shown that by regulating the diet of a pregnant woman it is possible to influence materially the size, weight, and bony development of the unborn child. In a series of forty-eight cases, he was able, by reducing the diet of the mother, to secure normal deliveries at full term, whereas in previous pregnancies, owing to the size of the child, the use of instruments or the induction of premature labour had been necessary. In these cases the male children were 11 per cent. and the female children 14 per cent. below the average weight.

Dr. Noel Paton's experiments point in the same direction. Dr. Paton kept two sets of pregnant guinea-pigs under precisely similar conditions, with the exception that while in the one set the animals were fully fed, in the other they were kept under a low diet, which was regulated so as to check the rapid increase in weight of the pregnant animals. It was found that whereas the young of

the fully fed guinea-pigs weighed $\cdot 35$ gram per gram of the mother's weight, the young of the animals kept on the low diet weighed merely $\cdot 248$ gram per gram of the mother. The average weight of the litter in the under-fed guinea-pigs was no less than 28 per cent. below that of normal animals. These experiments tell strongly against the hypothesis that the nutrition of the fœtus takes precedence over that of the mother, for were it true, we should find, as Dr. Paton points out, that "in badly nourished mothers each gram would produce a greater proportionate weight of young than in well-nourished mothers,"¹ which is precisely the opposite of the results obtained in the experiments. But adverse intra-uterine conditions are by no means limited to lack of nutrition. It has been proved beyond all doubt that poisons may pass freely from the mother to the unborn child. By experiments on animals, and observations on the human subject, M. Nicloux has demonstrated that alcohol passes, as alcohol, from the maternal to the fœtal circulation, and there is evidence that other poisons are transmitted in the same way. From the experiments of M. Féré and other observers, there are reasons for thinking that such poisons tend to produce malformations in the unborn child.²

We may conclude, then, that the weight of

¹ Paton, "The Influence of Diet in Pregnancy on the Weight of the Offspring," *Lancet*, July 4, 1903.

² Ballantyne, "Ante-natal Pathology and Hygiene."

evidence is distinctly against the view that the child of an under-fed mother is necessarily or even usually successful in an ante-natal struggle for nourishment between mother and child, and as victor in the struggle "arrives in the world with a full chance of living a normal physical existence." It is much more probable that lack of nourishment, intemperance, and other adverse maternal conditions have a definite effect on the unborn child, and are therefore responsible for some part of the physical deficiency and infantile mortality which disgrace our large centres of population. If we wish to improve the physique of the people we shall do well to attend to the conditions affecting the child before as well as after birth.

Of the adverse influences affecting the infant after birth we have more definite knowledge, although on this, as on all questions of infantile mortality, much yet remains to be said. Such influences include what are known as "insanitary conditions,"—overcrowding, dirty, ill-lighted, badly ventilated dwellings, defective refuse removal, and the like. Much more important than these, however, is the personal care the child receives during the first few months of his existence. Whether or not he will emerge safely from the troubles that beset that critical period, the first year of his life, depends above all things on the way he is "mothered"; and of the many qualities which go to make up good "mothering," the most important is the proper administration of good food. This

fact, which is so well known as to require little further consideration, will be dealt with later.

After this brief survey of the main conditions acting injuriously on infant life, we may proceed to enquire to what extent information as to their relative importance is afforded by the mortality tables. The table opposite p. 22, which the writer has extracted from the annual reports of the Registrar-General, gives the chief causes of infantile mortality since 1876.

It is most difficult to define the extent to which hereditary, intra-uterine and post-natal influences are respectively responsible for the heavy mortality recorded in this table. The disease which most definitely depends upon heredity is syphilis, and it is satisfactory to note that the mortality from this disease has declined during the more recent years. Tuberculosis also shows a reduction, but the influence of heredity in this disease is not now regarded as so important as was thought some years ago; the actual transmission of the virus from parent to child is an extremely rare event, all that is handed down is a predisposition to succumb to the attack of the tubercle bacillus, and even this is denied by some authorities. But the influence of heredity is far from being limited to syphilis and tuberculosis; it could be traced probably in most, if not in all, of the other causes of death, were we in possession of fuller knowledge. With our present knowledge, however, it is impossible to say to what extent and in what

way heredity is responsible for infantile mortality, and still less is it possible to frame an effective scheme of preventive action.¹ The control of the hereditary tendencies to disease is the great work of the preventive medicine of the future; at present the administrator can only wait until the investigator has furnished him with fuller knowledge.

The causes of death, which depend chiefly on conditions of environment affecting the unborn child, are premature birth and congenital defects, and it is noteworthy that the mortality from these causes has increased considerably. The increase in the mortality from premature birth is, indeed, one of the most striking features of the table. Probably, however, the increased mortality recorded under this heading is really due to some extent to a transference to the death registers of children who would formerly have been buried as still-born; but our defective system of death registration, which makes no provision for the registration of still-born infants, does not admit of a conclusive statement being made on this disputed point. Elsewhere² the writer has given reasons for the opinion that this hypothesis will not explain all the facts, and that the increase

¹ The difficulty of applying preventive measures to syphilis does not depend on lack of pathological knowledge, but on other conditions which, for obvious reasons, cannot be discussed here.

² "The Influence of Ante-Natal Conditions on Infantile Mortality," *British Medical Journal*, August 13, 1904.

DEATHS OF INFANTS UNDER ONE YEAR PER 1,000 BIRTHS REGISTERED.

ENGLAND AND WALES.

Year.	Measles.	Whoop- ing Cough.	Pneumonia and Bronchitis.	Diarrhœal Diseases.	Convul- sions.	Denti- tion.	Suffoca- tion.	Atrophy, Debility, and Inanition.	Premature Birth.	Con- genital Defects.	Atelectasis and Cyanosis.	Tubercular Diseases.	Syphilis.	All other causes.	All causes.
1876	2.5	5.1	23.9	19.2	23.1	2.9	1.4	24.4	12.8	1.2	.79	9.4	1.8	18.2	146
1877	2.2	5.6	23.1	13.0	21.6	2.6	1.4	22.7	13.0	1.3	.81	9.4	1.7	18.3	136
1878	1.9	8.5	25.6	20.5	21.9	2.7	1.4	23.8	13.4	1.3	.83	10.1	1.8	19.2	152
1879	2.1	5.9	27.1	9.0	21.3	2.5	1.5	22.2	13.5	1.3	.90	9.0	1.7	18.3	135
1880	3.0	6.2	24.3	23.5	20.9	2.4	1.4	24.1	13.9	1.3	.95	10.8	1.8	19.2	153
1881	1.7	5.2	21.7	12.2	20.3	2.7	1.5	21.3	13.6	1.3	1.5	8.6	1.7	16.3	130
1882	3.2	7.0	25.0	13.8	20.7	2.8	1.5	21.8	13.9	1.4	1.6	9.0	1.9	17.1	141
1883	2.1	5.0	24.1	13.0	20.5	2.8	1.6	22.9	14.4	1.3	1.5	8.6	2.0	17.0	137
1884	2.7	5.5	22.9	22.0	20.7	2.9	1.5	22.3	14.4	1.4	1.4	9.2	1.9	17.1	147
1885	3.3	6.4	26.3	12.0	20.2	2.9	1.5	21.1	14.4	1.4	1.7	8.3	1.8	17.2	138
1886	2.7	6.2	24.5	21.5	20.6	3.0	1.6	23.0	15.1	1.3	1.7	9.6	1.9	16.1	149
1887	3.8	5.3	24.9	18.9	20.1	2.6	1.6	22.9	15.8	1.4	1.6	8.7	1.8	15.1	145
1888	2.2	6.1	25.5	12.1	19.6	2.6	1.8	20.9	15.9	1.3	1.7	8.4	1.7	16.3	136
1889	3.5	6.0	25.4	17.4	20.3	2.7	1.8	21.0	16.3	1.4	1.7	8.8	1.7	16.3	144
1890	3.0	6.8	28.0	17.7	20.5	2.9	2.0	21.7	17.4	1.4	1.7	9.3	1.7	17.3	151
1891	2.9	6.4	30.6	14.2	20.4	2.8	2.1	21.3	17.9	1.4	1.8	8.6	1.5	17.5	149
1892	3.1	6.5	27.4	16.5	19.6	2.7	2.0	21.3	18.4	1.5	2.0	8.4	1.5	17.5	148
1893	2.6	4.9	23.7	30.0	19.6	2.6	2.0	22.9	18.8	1.6	1.9	9.2	1.7	17.3	159
1894	2.9	6.5	27.2	13.5	17.6	2.4	2.0	19.0	17.7	1.6	2.1	7.4	1.6	15.4	137
1895	2.7	4.7	26.7	30.3	19.0	2.6	2.2	22.6	18.9	1.5	2.1	8.2	1.6	18.4	161
1896	4.3	6.6	25.7	22.6	17.3	2.4	2.1	20.0	18.9	1.5	2.3	7.1	1.4	15.6	148
1897	3.3	5.9	24.7	33.1	17.3	2.4	2.0	20.4	19.2	1.5	2.1	7.4	1.4	15.6	156
1898	3.2	5.1	24.3	38.4	17.1	2.3	2.1	20.6	19.8	1.6	2.2	7.6	1.3	14.7	160
1899	2.4	5.2	24.6	41.7	16.8	2.2	2.0	20.6	19.9	1.6	2.3	7.1	1.3	15.7	163
1900	3.3	5.9	25.8	30.5	17.2	2.3	2.0	20.5	19.9	1.6	2.4	6.7	1.2	14.8	154
1901	2.2	5.3	22.4	34.5	16.6	2.2	1.8	20.0	19.9	3.8	1.2	6.4	1.2	13.8	151

Diarrhœal Diseases include Diarrhœa, Infective Enteritis, Dysentery, Enteritis, English Cholera, Gastro-Enteritis, Dyspepsia, Gastric Catarrh, and other Diseases of the Stomach.

is, to some extent at all events, real and not merely apparent. As there is no evidence of the increased action of agencies specially inimical to premature infants, it would appear that an increased mortality from premature birth implies an increase in the number of premature infants born, an important point for the consideration of those interested in the question of physical deterioration, especially when taken in conjunction with the declining birth-rate.

Fuller knowledge is badly needed on this important question, and it is to be hoped that a better system of death registration may soon furnish investigators with more adequate data.

In the light of the observations of Dr. Prochownick and Dr. Noel Paton it seems reasonable to conclude that adverse intra-uterine conditions are more or less responsible for many of the deaths due to defective nutrition, such as those recorded under the heading of atrophy, debility, marasmus and inanition, and are probably operative in increasing the mortality attributed to many of the other causes of death in the table. Fortunately, there are signs that the importance of the influence of intra-uterine conditions on the future development of the child is being increasingly recognised. The publication of Dr. Ballantyne's great work, which should be read by all students of infantile mortality, has given an impetus to the study of ante-natal pathology and hygiene, and we may anticipate that the future will bring a substantial

accession to our knowledge of this difficult but most important subject.

For the prevention of the infantile mortality arising from adverse intra-uterine conditions we must look to agencies which will regulate the life of the mother during pregnancy, so as to secure for her such conditions as rest, a sufficiency of good food, freedom from anxiety, abstinence from alcohol and other injurious drugs, and the maintenance of a high standard of personal hygiene. It is obvious that the task of securing such conditions for the women of the poorer classes is one of enormous difficulty, opening up, as it does, the consideration of those two great problems—the problem of poverty and the problem of the individual character. But, difficult as the task is, it must not be shirked. Education by health visitors may do much, and much may be said for the pre-maternity hospital. Amongst the French, from whom we have much to learn in most matters relating to infantile mortality, the pre-maternity hospital has a recognised place as an aid to “puericulture.”¹ Professor Pinard has brought forward evidence as to the value of these institutions on the nutrition of the unborn child.² He ascertained the weight of the newly-born infants of three groups of mothers, all of whom were delivered in lying-in hospitals. Each group consisted of 500 women, and pathological cases were

¹ Bouchacourt, “La Grossesse,” Paris, 1901.

² Pinard, *Gazette des Hopitaux*, November 28th, 1895.

excluded. The first group consisted of women who had worked until the onset of labour, the second of women who had spent at least ten days in a refuge before confinement, and the third group of women who had resided for some time before delivery in the wards of a maternity hospital, the Clinique Baudelocque. The average weight of the infants was as follows: In group (1) 3,010 grams, in group (2) 3,290 grams, in group (3) 3,366 grams. He also found that preliminary rest had a good effect in preventing premature labour. He ascertained, by the customary calculation, the duration of pregnancy in two groups each of 1,000 women. The first group consisted of women who had worked up to their confinement, the second of women who had for some time before confinement stayed in a hospital or refuge. The duration of pregnancy was as follows:—

Duration of Pregnancy.	No. of Cases.			
	Group I.		Group II.	
280 days or more	482	...	660
270 to 280 days	279	...	214
Less than 270 days	239	...	126

These results are most suggestive, and as the function of maternity receives fuller recognition in modern civilised communities we may anticipate a greater development of the pre-maternity hospital.¹

The causes of death which depend chiefly upon

¹ The provision of pre-maternity hospitals was one of the recommendations of the New South Wales Royal Commission on the Decline of the Birth-rate.

conditions affecting the infant after birth are measles, whooping cough, pneumonia, bronchitis, diarrhœa, dentition, and suffocation or over-lying. The increased mortality from the latter cause is highly discreditable, and calls for the application of stringent methods of dealing with the parents of infants killed in this manner. As death often occurs while the parents are in a state of intoxication, the mortality from over-lying may be regarded as forming part of the effect of alcohol on the death returns.

A study of the table serves to bring out the enormous importance of the food factor in infantile mortality. Improper feeding is the cause of the mortality from diarrhœa and dentition, and of much of that from convulsions, tuberculosis and atrophy, debility and inanition. Medical opinion, both in this country and abroad, is practically unanimous as to the immense importance of infant feeding. During the first year of life food is badly wanted to build up new tissue, for growth proceeds with a rapidity which is never approached in after life. At five months the infant weighs, or should weigh twice, and at twelve months nearly three times his weight at birth; and as all this material must be built up from food, it is evident that to the infant the food question is one of paramount importance. The effect of improper feeding on infantile mortality is, however, of such consequence, that the question of infant feeding must be reserved for further consideration in the next chapter.

CHAPTER III.

INFANT FEEDING.

THAT human milk is much the best food for human infants is a conclusion suggested by common sense and amply confirmed by the united testimony of physiology, statistics and clinical evidence. It is the great central fact in infant feeding. The more we advance in the knowledge of the closely-allied subjects of infantile mortality and infant feeding, the more evident it becomes that in human milk we have a unique and wonderful food for which the ingenuity of man may toil in vain to find a satisfactory substitute.

The first point to bear in mind in the consideration of this question is that the premature substitution of the bottle for the mother's breast is as much a pathological process as is the premature birth of an infant. Although, *physically*, the child is separated from the mother at birth, *physiological* separation takes place only at weaning. "From a physiological standpoint, the artificially-fed baby is a premature child, and anything but maternal milk is foreign to its digestive tract."¹ From this

¹ Chapin, "Breast-feeding and the Infants' Development," *Arch. of Pediatrics* (New York), August, 1904.

fundamental fact in the physiology of infant feeding we should expect to find that what may be termed pathological weaning would be often followed by disaster, and this is precisely what we do find in practice. The milk of any species of animal is a highly specialised product, specialised mechanically, chemically and physiologically to suit the digestive system, nutrition, rate of growth and mode of life of the animals of that species, and it cannot with impunity be displaced by a foreign milk. This subject is so important that it may be considered in fuller detail.

Dr. Chapin has called attention to the significance of the comparative anatomy of the digestive tract in relation to infant dietetics.¹ He points out that in each species the "milk of the mother behaves in the young animal's stomach very much as the food of the mother behaves in her stomach. The young animal is being educated to digest in the same manner as it will when it is grown." In the cow, goat and sheep there are four stomachs, which together form about 70 per cent. of the digestive tract, and the outlet between the fourth stomach and the intestine is small, admitting of the passage of only liquid or semi-liquid food. On the other hand, in the horse and ass, which eat the same kind of food as the cow, there is but one stomach, which forms only 8 or 9 per cent. of the digestive tract and holds not more than one-half

¹ Chapin, "Theory and Practice of Infant Feeding," 1903.

of a meal. The outlet to the intestine is large, and at the other end of the intestine is an enormous cæcum, which forms about 60 per cent. of the entire digestive tract. These differences in structure suggest differences in the process of digestion. Although these animals eat the same food, it is evident that in the former digestion must take place chiefly in the stomach, and in the latter chiefly in the intestine, and this is what actually happens. Now, the milk of each species is suited to the structural character of the digestive apparatus. The milk of the cow clots with a firm hard curd, which must be digested before it can pass from the stomach to the intestine; the milk of the horse, on the contrary, forms a jelly-like clot, which passes readily into the intestine, where it is digested. Thus from the same food these animals produce milks of widely different properties. The human stomach forms about 20 per cent. of the digestive tract, and the outlet to the intestine is small. It would appear, therefore, that this stomach is adapted for the reception of finely-divided material which can be passed easily into the intestine, where the main part of digestion occurs. The indigestion which follows defective mastication confirms this conclusion, and so does the behaviour of human milk, which in clotting forms not a solid lump, nor a fluid jelly, but a soft, finely-divided mass.

The chemical differences are even more striking. Professor von Bunge has pointed out that some

idea of the marvellous selective action of the milk-secreting cells may be gained from a comparison of the salts of the milk of an animal with the salts of its blood and serum, and also with the salts of the suckling's body. The following table gives the percentage composition of the ash of the rabbit.¹

	Rabbit, aged 14 days.	Milk of Rabbit.	Blood of Rabbit.	Serum of the Blood of Rabbit.
K ₂ O ...	10·8	10·1	23·8	3·2
Na ₂ O ...	6·0	7·9	31·4	54·7
Ca O ...	35·0	35·7	0·8	1·4
Mg O ...	2·2	2·2	0·6	0·6
Fe ₂ O ₃ ...	0·23	0·08	6·9	0
P ₂ O ₅ ...	41·9	39·9	11·1	3·0
Cl ...	4·9	5·4	32·7	47·8

Although the milk is manufactured from the blood, the composition of the two fluids is widely different. In inorganic salts the mother's milk closely resembles in composition the tissues of the young animal, while the mother's blood from which the milk is made is of a different composition. The making of milk is not a mere filtration from the blood, but a biological process depending on the vital activity of the milk-secreting cells of the breast; and the more the comparative chemistry of milk is studied, the more clearly does it appear that the milk of each species is specialised to meet the needs of the animal. The following table

¹ Von Bunge, "Die zunehmende Unfähigkeit der Frauen ihre Kinder zu stillen," Munich, 1903.

gives the chief constituents of the milk of fifteen different species.¹

	Proteid.	Fat.	Milk Sugar.	Ash.
Man ...	1·6	3·4	6·1	0·2
Dog ...	7·3	11·9	3·2	1·3
Cat ...	7·0	4·8	4·8	1·0
Rabbit ...	10·4	16·7	2·0	2·5
Guinea-pig	5·2	7·1	2·2	0·8
Pig ...	5·1	7·7	3·3	0·8
Mare ...	2·0	1·2	5·7	0·4
Ass ...	2·2	1·6	6·0	0·5
Cow ...	3·5	3·7	4·9	0·7
Goat ...	3·7	4·3	3·6	0·8
Ewe ...	4·9	9·3	5·0	0·8
Reindeer...	10·4	17·1	2·8	1·5
Camel ...	4·0	3·1	5·6	0·8
Lama ...	3·9	3·2	5·6	0·8
Dolphin ...	7·6	43·8	—	0·5

The variations in sugar and fat have probably in part a climatic origin. In the milk of animals living originally in hot climates, such as the camel, the fat is relatively low and the sugar relatively high; but as milk fat has more than twice the heat-producing power of milk-sugar, it is important that an animal, such as the reindeer, which inhabits a cold climate, should have a milk rich in fat. In the milk of the dolphin, which inhabits the waters of the colder regions, the fat percentage is no less than 43·8. Prof. Bunge regards the relative proportion of sugar and fat in

¹ Von Bunge, *op. cit.*

human milk as evidence of the tropical origin of the human race.

The milks are specialised to suit the varying rates of growth of the young of the different animals. The food constituents which are most essential to build up the tissues are the proteids and the salts, and in a rapidly growing animal the milk should contain a large proportion of these constituents. The next table shows the close correspondence between the proportion of the proteids and salts and the rate of growth of the young animal.¹

	No. of Days in which the newly- born animal doubles its Weight at Birth.	For 100 Units of Weight the Milk contains			
		Proteid.	Ash.	Calcium Oxide.	Phosphoric Acid.
Man ...	180	1'6	0'2	0'033	0'047
Mare ...	60	2'0	0'4	0'124	0'131
Cow ...	47	3'5	0'7	0'160	0'197
Goat ...	22	3'7	0'8	0'197	0'284
Ewe ...	15	4'9	0'8	0'245	0'293
Pig ...	14	5'2	0'8	0'249	0'308
Cat ...	9½	7'0	1'0	—	—
Dog ...	9	7'4	1'3	0'455	0'508
Rabbit...	6	10'4	2'5	0'891	0'997

Another important chemical difference, which, however, does not appear in the above analyses, is that human milk is relatively rich in lecithin, a substance which forms a large part of the brain

¹ Von Bunge, *op. cit*

and nerves. Animals such as the calf, colt, lamb, etc., are born with a fully-developed nervous system, and a few days after birth lead much the same life as the mother. They do not require, therefore, so large a proportion of lecithin in the mother's milk as does the human infant, whose nervous system is to a large extent undeveloped before birth, and develops rapidly during the period of suckling.¹

Recent research has led to the discovery of profound physiological differences between the milks of various species. Milk is not an inert liquid depending for its nutritive properties on the chemical substances it contains; it is a living liquid with important biological properties. Milk contains soluble ferments which no doubt play an important part in the nutrition of the infant. It has long been known that the processes of digestion are chiefly carried on by ferments elaborated in the digestive tract and its appendages, and there is now good reason to think that the processes of assimilation depend largely upon the presence of ferments elaborated in internal secretions. Zweifel, Czerny and other observers have found that the infant's blood and digestive juices are relatively poor in ferments, and according to the hypothesis of Escherich and Marfan it is an important function of mother's milk not only to supply a food suited mechanically and chemically

¹ Chapin, "Infant Feeding."

to the infant's feeble digestive capacity, but also to furnish ferments which stimulate and regulate the nutrition of the infant's tissues. It is true that cow's milk also contains ferments, but they differ from those in human milk. For instance, the latter contains an amylolytic ferment which is absent from the milk of the cow.¹

There are, however, still more subtle differences. When an animal is attacked by bacterial or other poisons, it reacts by forming in the blood certain protective substances which tend to neutralise the poison. These are the "anti-bodies," and of such is the anti-toxin of diphtheria. Now, Bordet has found that when the milk of an animal of one species is injected into an animal of another, the serum of the latter forms a substance which has the power of coagulating the milk of the former. The reaction, moreover, is specific; for example, if the cow's milk is injected into a horse, the horse's serum will acquire the power of coagulating the milk of a cow, but not that of a goat, ewe, or other species. Moro regards this clotting substance, or "precipitin," as an anti-body, analogous to the anti-bodies formed to resist poisons, and he contends that milk from a foreign species is, in a sense, a poison. Hamburger affirms that foreign milk is poisonous to the cells lining the digestive tract, so that a hand-fed baby has to produce an

¹ Marfan, "Traité de l'Allaitement."

intestinal anti-body before it can set to work to digest and absorb its food, and Moro finds this opinion supported by the fact that while digestion leucocytosis is absent in the breast-fed baby, it is marked in infants fed by hand, pointing to the production of an active immunity against the poisonous effect of foreign milk.¹ But this is not all. There is evidence that mother's milk contains anti-bodies derived from the mother, and that these anti-bodies carried by the milk into the infant's body protect it from the onslaught of disease-producing bacteria. Moro finds that the blood of the breast-fed baby has a greater bactericidal action than that of the hand-fed baby; and the Widal reaction, which depends on the presence of an anti-body, has been obtained from the milk of mothers with typhoid fever, and from the blood of their healthy sucklings.

These facts are in accord with clinical experience. It is well known that sucklings have a marked immunity from infectious disease. Professor Roger² has published particulars of forty-nine nursing mothers who were admitted into the isolation hospital of La Porte d'Aubervilliers. Of these women fifteen had measles, nineteen scarlet fever, eight tonsillitis, one diphtheria, five erysipelas, and one mumps. Although the mothers

¹ Moro, "Biologische Beziehung zwischen Milch und Serum"; *Wiener Klin. Woch.*, 1901.

² Roger, "Étude clinique sur quelques maladies infectieuses," *Revue de Médecine*, April, 1900.

continued to suckle their babies, with the exception of one debilitated child who was attacked by a terminal erysipelas, in no case did the infant contract the disease.

From the foregoing facts it may be inferred that in the struggle for existence the breast-fed baby will have a much better chance of survival than his hand-fed brother, and that such is the case in practice is the unanimous opinion of the medical authorities in this country, on the continent and in America. There is now a considerable and rapidly increasing volume of statistical evidence which proves the comparative immunity of the breast-fed baby from disease. As some figures on this point are given in the next chapter it will be enough here to quote the result of the investigations of Dr. Hope, who found that in Liverpool the deaths from diarrhœa "amongst children under three months of age, either wholly or partially fed on artificial foods, are fifteen times as great as they are amongst an equal number of infants fed upon breast milk"; *i.e.*, that out of one thousand breast-fed infants under three months in Liverpool twenty will die from diarrhœa, while amongst one thousand hand-fed infants at the same age the deaths will be no less than three hundred.

It is evident, then, that whatever may be the case in other branches of human experience, in infant feeding Nature is superior to art. In other regions of physiology art may meet with more success.

It is possible that by vast resections in the abdomen something may be done to hasten the coming of the superman, who will attain the years of the patriarchs. But in the feeding of babies we do well to take Nature as our guide, and great indeed must be the advance in human knowledge before we shall find an adequate substitute for the food which the lacteal cells build up from the blood of the nursing mother.¹

¹ Readers of Metchnikoff's "Nature of Man" may study with profit Sir Wm. Macewen's Huxley Lecture on the "Function of the Cæcum and Appendix," published in the *British Medical Journal* of October 8th, 1904. Sir William enters a powerful plea on behalf of the present structure of man. He has a good word even for the despised appendix.

CHAPTER IV.

INFANT FEEDING (*continued*).

BREAST-FEEDING is undoubtedly the best method of infant feeding, but there is little doubt that breast-feeding is becoming increasingly difficult to secure. The writer is not in possession of any statistics which support this view, but he knows no medical practitioner of long experience who does not agree to it. The human infant tends more and more to become a parasite of the milch-cow.

There is a tendency to assume that artificial feeding is a phenomenon entirely or almost entirely due to social and economic conditions, and to neglect possible physiological factors. No doubt social and economic conditions have much to answer for in this connection. Amongst the poor the necessity of earning a living frequently compels the mother to give up nursing her infant, while in the more well-to-do classes breast-feeding is often deemed to be incompatible with what are called "social duties." But the widespread decline of breast-feeding in modern civilised communities cannot altogether be explained in this way. There is reason to believe that the function of maternity

is undergoing atrophy in the women of modern civilisation. Professor von Bunge, who has devoted much attention to this subject, believes that in the cities of central Europe more than half the mothers are physically incapable of suckling their infants. With the help of over a hundred of his pupils, medical practitioners in Germany, Austria and Switzerland, he has collected particulars of about 2,000 families, and his enquiries have convinced him that most of the mothers who do not suckle are physiologically incapable of suckling. He also believes that inability to suckle is a symptom of degeneration, that it is handed down from mother to daughter, and that it is often brought about by alcoholism in the parents, usually in the father.¹ In America Dr. Holt finds that incapacity to suckle is increasing: "Among the well-to-do classes in New York and its suburbs, of those who have earnestly and intelligently attempted to nurse, not more than 25 per cent., in my experience, have been able to continue satisfactorily for as long as three months. An intellectual city mother who is able to nurse her child successfully for the entire first year is almost a phenomenon. Among the poorer classes in our cities a marked decline in nursing ability is also seen, although not yet to the same degree as in the higher social scale."² On the other hand,

¹ G. v. Bunge, *op. cit.* See also his later pamphlet, "Alkoholvergiftung und Degeneration," Leipzig, 1904.

² Holt, "Diseases of Infancy," 1903.

Dr. Marfan, from his observations in Paris, concludes that not more than 10 per cent. of mothers are physically incapable of nursing, and that the most frequent causes of the failure of mothers to nurse their infants are, amongst the rich, custom, "la mode," and the egoism of the mother or father; amongst the poor, ignorance, indifference and poverty. Dr. Nordheim, who has made similar enquiries in Munich, has arrived at much the same result.¹

But whatever the causes of artificial feeding may be, and whether it is or is not increasing, there can be no doubt that the practice is deeply rooted in our social life. Doubtless breast-feeding could be increased by the growth of a more healthy public opinion on this question, by special factory legislation, and by the establishment of "Consultations de Nourrissons" on the methods described in the next chapter; no doubt, also, ministers of religion could do much to help on this good work by preaching breast-feeding as a social duty, but it is to be feared that in the absence of something like a revolution in our social and economic organization artificial feeding will continue to be so prevalent as to make the difference between good and bad artificial feeding a matter of immense importance.

The problem of finding a satisfactory substitute for mother's milk is one of great difficulty, and it

¹ Marfan, "Traite de l'Allaitement," Paris, 1903.

may be questioned whether it will ever be completely solved. In the meantime thousands of mothers have to feed their children as best they can, and while our knowledge of artificial infant feeding is so defective that physicians of the highest eminence hold the most diverse opinions on such subjects as the relation of sterilized milk to infantile scurvy, and the desirability of modifying cow's milk for infants, it is not surprising that the ordinary housewife should fail to achieve satisfactory results. Amongst the poor the grossest mistakes are made: young infants are not infrequently given such articles as hard-boiled eggs, cheese, carrots, beer, and even spirits, and other items of the comprehensive dietary known as "what we have ourselves." Assuming, however, that the mother has sufficient intelligence to avoid such lethal dietetic errors, she has three classes of food from which to select a substitute for human milk, viz., proprietary foods, condensed milk, and cow's milk more or less modified and artificialised.

PROPRIETARY FOODS.

In seeking for a substitute for mother's milk it should be borne in mind, as Dr. Chapin points out, that "anything aside from breast-milk that is put into an infant's stomach is a foreign substance,"¹ and the aim should be to obtain a food resembling as closely as possible human milk. Tried by this

¹ Chapin, "Infant Feeding."

standard proprietary foods are at once put out of court. Milk is a purely animal product, while proprietary foods are largely vegetable in composition, as nearly all contain wheat flour or other matter of vegetable origin, and many contain unaltered starch, a substance the young infant is quite unable to digest. Generally speaking, these foods are deficient in fat, too rich in carbohydrate, and lack the anti-scorbutic elements. Moreover, while milk is a living fluid with biological properties whose importance we are only beginning to appreciate, proprietary foods are merely so much inert dust, and whatever their chemical composition may be they are deficient in nutritive qualities. It must be borne in mind that food values cannot adequately be expressed in terms of chemistry. The digestive tract is not a test-tube, and the processes of nutrition are far too complex to be explained by chemical and mechanical formulæ. Amongst those practitioners who have taken the trouble to inform themselves on the subject of infant feeding, and who are alive to their responsibilities as family advisers, proprietary foods are not in favour, and such practitioners will not dispute the following words of Professor Rotch, who is, as is well known, one of the most distinguished authorities on infant feeding:—

“As my experience in the feeding of infants increases, and as I examine year by year the effects of the different foods on infants, I am strongly impressed with the belief that with our

present physiological, chemical and clinical knowledge all the patent foods are entirely unnecessary. . . . It is high time for physicians to appreciate exactly how inefficient in themselves and how misleading in their claims are these artificial foods, and also in what a false position, as the protector of and advisor to the public, our profession is placed whenever it lends itself to even a toleration of their use. I speak of them here simply because there is no doubt that they are kept in the market by the physician rather than by the manufacturer. The latter is only doing what any capitalist interested in a business venture would do. The former, it seems to me, is, perhaps unintentionally, aiding the business interests of others at the expense of his own future reputation as a scientist.”¹

CONDENSED MILK.

Condensed milk is a popular infant food. It appears to be cheap, it is easy to prepare, and is not infrequently recommended by medical men as being “safer” than cow’s milk in hot weather.

In nutritive properties condensed milk is seriously deficient. Apart from the separated

¹ Rotch, “Pediatrics—The Hygienic and Medical Treatment of Children.” It is to be regretted that attempts are now being made to secure the hall-mark of municipal approval for certain proprietary foods termed “dried milks.” An infant’s food should be as little artificialised as possible. Even sterilized and pasteurized milk should be regarded merely as makeshifts, to be abandoned when it is possible to adopt aseptic methods of milk-production.

condensed milks, which are destitute of fat, it may be said that most of the brands of condensed milk upon the market are deficient in fat, and contain an excessive amount of cane-sugar, while all lack the anti-scorbutic elements. There is abundant clinical evidence to associate condensed milk and rickets, malnutrition and infantile scurvy as cause and effect.

The popular idea that condensed milk is a comparatively "safe" food during the diarrhœa season is not in accord with fact. Dr. Newsholme found that in 191 cases of fatal diarrhœa in Brighton in the three years 1900-02¹ the method of feeding was as follows:—

Breast	9·4 per cent.
Cow's milk	...	46·6	„ „
Condensed milk...	44	„ „	

Dr. Meredith Richards² investigated 183 deaths from diarrhœa in infants under six months in Croydon during the same years, and found the method of feeding to be as follows:—

Breast	14 per cent.
Cow's milk	...	48	„ „
Condensed milk	...	33	„ „

Of course, these figures cannot be taken as showing the relative incidence or fatality of diarrhœa in infants fed on cow's milk and condensed milk

¹ Newsholme, "Annual Report on the Health of Brighton," 1902.

² Richards, *Journal of Hygiene*, 1903.

respectively, as the number of infants comprised in each of these two classes is not stated.

In order to obtain more precise information on this point Dr. Newsholme collected particulars as to the method of infant feeding of all infants in the poorest streets in Brighton during 1903. The particulars gathered in this census of infant feeding related to 337 infants living in 2,671 houses, and the information was used as a likely index of the conditions of feeding to which infants are subjected. During the year there were forty-four infantile deaths from diarrhœa in Brighton, and in each case particulars as to the method of feeding were ascertained. The information thus obtained is set out in percentages as follows:—

PERCENTAGE OF INFANTS UNDER ONE YEAR OF AGE
FED IN DIFFERENT WAYS.

	A. In 2,671 Houses Visited House-to- House.	B. Among Infants of Epidemic Diarrhœa in 1903.
1. Suckled alone	61·7	6·8
Ditto and farinaceous food ...	12·2	4·6
Ditto and cow's milk	2·1	2·2
Ditto and condensed milk ...	0·9	—
2. Cow's milk alone	8·3	27·1
Ditto and farinaceous food ...	9·5	11·5
3. Condensed milk alone	2·7	43·2
Ditto and farinaceous food ...	1·8	—
4. Patent foods only mentioned ...	0·8	—
5. Unknown	—	4·6
	100·0	100·0

Though the data are somewhat scant, these figures tell strongly against the alleged "safety" of condensed milk, for the deaths amongst the infants fed on it were about seventeen times more than they ought to have been, assuming that there was an average distribution of diarrhœa amongst the infants fed in different ways. Dr. Newsholme's conclusion is that so far from protecting against diarrhœa the use of condensed milk increases its incidence.¹

There is, therefore, no reason to think that the infants fed on condensed milk are more secure from diarrhœa than those fed on cow's milk. Nor is this surprising. When the tin is opened condensed milk is as liable to contamination as cow's milk, especially as the tin contains sufficient material to last two or three days. Moreover, condensed milk is not necessarily sterile. During the years 1900-02 seventy-five samples of condensed milk were examined by the Bacteriologist of the Liverpool Health Department, and the majority were found to be not sterile.² And it does not follow that those samples which were sterile, *i.e.*, containing no living organisms, were necessarily non-toxic. Moreover, further information is required as to the relation of attack-rate to death-rate in infants fed on condensed milk and

¹ Newsholme, "Annual Report on the Health of Brighton," 1903.

² Hope, "Annual Report on the Health of the City of Liverpool," 1902.

other foods. The case mortality in infants whose nutrition has been impaired by a condensed milk diet may be exceptionally heavy, as would appear from the enquiries of Drs. Park and Holt in New York. If this be so, a comparatively small number of tins containing infective material may give rise to a disproportionately large number of deaths.

Methods of feeding are, however, of importance in connection with diseases other than diarrhœa. There is need for more knowledge on this subject. What is wanted is an investigation, clinical, pathological and bacteriological, into the various methods of artificial feeding and their influence on nutrition. We want to know more of the influence of various foods on the child's powers of resistance to disease in general and to certain diseases in particular. It is probable that fuller knowledge would reveal further serious disadvantages to the use of patent foods and condensed milks. Drs. Park and Holt have lately conducted an inquiry somewhat on these lines in the tenement-houses of New York City, and it is interesting to note that the results with condensed milk in the summer observations were particularly unsatisfactory. "These children were often apparently in good condition until attacked with acute disease, when they offered but little resistance, and seemed to succumb more quickly than any other class of patients."¹

¹ Park and Holt, "Report upon the Results with different kinds of Pure and Impure Milk in Infant Feeding in

Dr. Niven has compiled the following interesting table in connection with the question of the relation of condensed milk to infantile mortality.¹

TWO DISTRICTS OF MANCHESTER, SHOWING THE COMPARATIVE FEEDING OF 533 CHILDREN.

Method of Feeding.	Ancoats (433).	Chorlton-upon-Medlock (100).
Breast-fed	85'9	81'0
Artificially fed	14'1	19'0
	100'0	100'0
Of the artificially fed :		
Cows' milk	62'0	89'0
Condensed milks	38'0	11'0
	100'0	100'0
Infantile mortality ...	234	184

This table shows that although rather more children were breast-fed in Ancoats than in Chorlton-upon-Medlock, the use of condensed milk was very much more common in the former district and was associated with a far higher rate of infantile mortality. It is not, of course, claimed that these figures are conclusive, but they are certainly suggestive and indicate a line of enquiry which might usefully be followed farther.

Tenement-houses and Institutions of New York City,' *Medical News*, New York, December 5th, 1903.

¹ Quoted by Dr. T. D. Lister, "Infant Feeding and Milk Supply," 1903.



Photo by]

OPEN AIR MILKING IN DENMARK,

[F. L. Dopp,

Cow's MILK.

We now come to the consideration of cow's milk, which is generally agreed by the profession to be the best substitute for human milk generally available. But though cow's milk resembles human milk much more closely than do patent foods or condensed milk, there are important points of difference apart from the question of contamination, bacterial or otherwise. Cow's milk has a hard curd, and is adapted for the digestion of an animal with four stomachs. The human infant has but one stomach, and that is adapted for the reception of a milk with a soft curd.

The chemical differences are as great as the mechanical. Whether an attempt should be made to lessen the differences between the two milks by a process of modification or "humanization" is, however, a matter of dispute. Professor Budin and the French physicians give sterilized milk unmodified, even to very young infants. Some writers, *e.g.*, Dr. Variot, affirm that it is modification and not sterilization that gives rise to infantile scurvy. On the other hand, Professor Rotch and the Americans, who have done much to place artificial infant feeding on a more scientific basis, insist on the importance of that highly individualised modification—percentage feeding. The weight of opinion in this country seems to be with the American rather than the French physicians, and in the present state of our knowledge it would appear to be safer to employ

some form of modification, although the American refinements are perhaps unnecessary for babies on this side the Atlantic.

In addition to the foregoing mechanical and chemical differences between human milk and cow's milk, there are the physiological differences indicated in the last chapter. The possibility of lessening these differences is, however, so remote that no practical purpose would be served by discussing it in these pages.

Another difference has still to be discussed. Although, unlike the foregoing, it is not inherent in the milks, it is extremely important, and its existence to its present extent is anything but creditable to our system of public health administration. This difference is that whereas human milk passes from the secreting gland direct to the baby's mouth and is practically sterile, cow's milk in making the journey between these two points is seriously exposed to contamination. Contamination by chemical preservatives, though not so frequent as formerly, is still far too common; but it is almost insignificant compared with the importance of bacterial contamination.

The process of milking as carried on in this country has been happily described in an admirable article by Dr. Leslie Mackenzie, Medical Member of the Local Government Board for Scotland:—

“To watch the milking of cows is to watch a process of unscientific inoculation of a pure (or almost pure) medium with unknown quantities of unspecified germs. . . . Whoever knows the meaning of aseptic surgery must feel

his blood run cold when he watches, even in imagination, the thousand chances of germ inoculation. From cow to cow the milker goes, taking with her (or him) the stale epithelium of the last cow, the particles of dirt caught from the floor, the hairs, the dust, and the germs that adhere to them. . . . Everywhere, throughout the whole process of milking, the perishable, superbly nutrient liquid receives its repeated sowings of germinal and non-germinal dirt. In an hour or two its population of triumphant lives is a thing imagination boggles at. And this in good dairies! What must it be where cows are never groomed, where hands are only by accident all washed, where heads are only occasionally cleaned, where spittings (tobacco or other) are not infrequent, where the milker may be a chance-comer from some filthy slum—where, in a word, the various dirts of the civilised human, are at every hand reinforced by the inevitable dirts of the domesticated cow? Are these exaggerations? They are not. I could name many admirable byres where these conditions are, in a greater or less degree, normal.”¹

But it is not only during the process of milking that cow's milk becomes seriously contaminated. From the time it is drawn from the ungroomed, filthy cows until by means of the long-tubed bottle it reaches the mouth of the baby, cow's milk is continually exposed to serious pollution, and gross bacterial fouling is so common as to be almost universal. The influence of bacteria-polluted milk on health is far from being fully understood, but it may be assumed that clean milk is preferable to dirty milk. We know, however, that milk has often acted as a carrier of the infections of enteric fever, scarlet fever, diphtheria, cholera and tuberculosis (although

Mackenzie, “The Hygienics of Milk,” *Edinburgh Medical Journal*, 1898.

its influence on the latter disease has possibly been exaggerated), and there is now a mass of evidence that certain forms of sore throat are closely associated with the consumption of milk from diseased cows. It is most probable that our list of milk-borne diseases is far from complete, and that fuller knowledge will add to the dangers we now know to exist in the present state of the milk supply.

The question of the chief place of contamination is important. In the case of the diseases already mentioned it is usually the farm, but in diarrhœa, the most fatal of the milk-borne diseases, contamination probably takes place chiefly in the home of the consumer. This view, however, is disputed by Professor Delépine, who, from the examination of a large number of milk samples during an investigation extending over seven years, has arrived at the conclusion that there is a distinct relationship between epidemic diarrhœa and food poisoning, that both are due to the infection of the food by members of the colon group of bacilli derived from faecal contamination, and that the contamination is chiefly derived from the farm.

“My results do not exclude infection at the home of the consumer, or during transit from the farm, but they indicate that infection at the farm, or through vessels infected at the farm and used by the farmer for the storage and carriage of milk, must be of paramount importance. None of the



Photo. by]

A GOOD MODERN DANISH COW-SHED.

This farm supplies milk to the "Kjøbenhavns Mælkeforsyning,"

[F. L. Dodd,

milk I have examined had been exposed to any influence attributable to a consumer's home. It will be noticed that a large proportion of the samples of milk obtained from cans at railway stations or at the farms is already infectious before it reaches the consumer; also the degree of noxiousness acquired through infection is proportional to the length of time the milk has been kept, and the temperature which it has been exposed to, before it reaches the consumer."¹

Dr. Newsholme does not accept this view.² He does not deny that serious epidemics of diarrhœa occur which are due to the contamination of a single milk supply, and that such epidemics are analogous to milk outbreaks of enteric fever; but he holds that "the ordinary sporadic cases of diarrhœa are due to domestic infection of milk or other foods, or to the direct swallowing of infectious dust." From an investigation of the different supplies of milk among the families in Brighton invaded by diarrhœa in the years 1900-02, he found no evidence of special incidence on single milk supplies. In the eighty-nine fatal cases of diarrhœa fed on cow's milk, there were no less than forty-one sources of milk supply, and thirty-one of the seventy-two dairies in Brighton

¹ Delépine, *Journal of Hygiene*, 1903.

² The importance of the home contamination of food in the causation of diarrhœa was first pointed out by Dr. Newsholme in his Presidential Address to the Incorporated Society of Medical Officers of Health, 1899. See *Public Health*, December, 1899.

had no fatal cases at all. He concludes that "Unless we assume that a very large proportion of non-fatal cases occurred, we must infer, in view of the diffusibility of milk, that most of these milk supplies were non-infective before they reached the home of the individual patient." Moreover, 9·4 per cent. of Dr. Newsholme's total 191 cases were breast-fed, and 44 per cent. fed on condensed milk.¹

Further evidence in support of Dr. Newsholme's view has been brought forward independently by Dr. Meredith Richards.² The latter writer examined the records of twenty-two cases of food poisoning, excluding cases due to tinned food, and found a striking difference between the seasonal incidence of these outbreaks and that of fatal diarrhœa. He also points out that Chesterfield, with a diarrhœal rate of 54·4 per 1,000 during the years 1896 to 1899, derived 98 per cent. of its whole milk supply from cowsheds situated within the borough or within a radius of five miles; and from an investigation of 253 fatal cases of diarrhœa occurring in infants in Croydon, over 12 per cent. were breast-fed, while only a little more than half received fresh cow's milk.

The investigations of Drs. Park and Holt in New York lend no support to Professor Delépine's

¹ Newsholme, "Remarks on the Causation of Epidemic Diarrhœa," *Transactions of the Epidemiological Society*, vol. xxii., N.S. See also "Annual Report on the Health of Brighton," 1902.

² Richards, *Journal of Hygiene*, 1903.

view. The ten physicians engaged in the enquiry were agreed that the most important factor was intelligent care, while "most of the physicians stated that, leaving out the very worst store milk in summer, the results were very much less affected by the character of the milk than they had anticipated, and distinctly less than by the sort of care the infants received."¹

On the whole, it may be said that the weight of evidence is distinctly in favour of the view that in fatal diarrhœa contamination of the food takes place chiefly in the home of the consumer.

But even the purest cow's milk of the most nicely adjusted percentage composition may be a source of danger in the hands of a careless or ignorant mother. The question of quantity, as well as quality, has to be borne in mind. The child may be over-fed, either by being fed too frequently or by being given an excessive amount at each meal. Both forms of over-feeding are common and give rise to serious consequences. Budin attaches great importance to "suralimentation" as a factor in the production of gastrointestinal disorders, and he lays stress on the advantages of supplying the day's milk in separate bottles, each bottle containing the proper quantity for one meal. By this method of supply, which is employed in most of the French Gouttes de Lait and in all the British milk depôts, the danger of over-feeding is considerably lessened, as both the

¹ Park and Holt, *op. cit.*

number of meals and the proper quantity at each meal are clearly indicated.

The conclusions reached so far may be stated thus :—

1. Infantile mortality is largely caused by improper feeding.

2. For the prevention of infantile mortality it is necessary to adopt special measures to improve the infantile food supply. Such measures should have for their object,

a. The encouragement of breast-feeding; and

b. The provision, for those infants for whom breast-feeding is impracticable, of proper quantities of pure cow's milk, safeguarded as far as possible from contamination within the home of the consumer. Attempts have been made to secure these objects by the establishment of the institutions described in the next two chapters.



THE "GOTA DE LECHE," MADRID.
Inaugurated January 22nd, 1904, by H.M. the Queen of Spain.

CHAPTER V.

THE "CONSULTATION DE NOURRISSONS"
AND THE "GOUTTE DE LAIT."

IN France, where an unusually low birth-rate has compelled the question of infantile mortality to be regarded as one of national importance, efforts have lately been made to improve the defective methods of infant feeding, which in France, as in this country, are held to be the chief factor in infantile mortality, by the establishment of organizations having for their object the encouragement of breast-feeding wherever possible, and the supply of sterilized milk for those infants for whom breast-feeding is impracticable. These organizations are of two types, the "Consultation de Nourrissons" and the "Goutte de Lait." The former is the earlier institution, and may be said to date from the year 1890, when Professor Herrgott founded "L'Oeuvre de la Maternité" at Nancy.¹ The infants born in this institution were required to be brought up by their mothers for medical examination one month after birth, and if

¹ Herrgott, "Annales de la Société Obstétricale de France," 1901.

the child's progress had been satisfactory the mother received a gift of money. In the years 1890-1900, 2,052 women passed through this institution, and 25,382 francs were distributed amongst them.

The Nancy maternity charity, however, as established in 1890, was a somewhat embryonic form of the Consultation de Nourrissons; the first fully developed example was founded by Prof. Budin at the Charité Hospital, Paris, in 1892, and two others were afterwards established by him, one at the Maternité Hospital in 1895, the other at the Clinique d'Accouchement Tarnier in 1898. Similar consultations have since been organised by Drs. Maygrier, Porak, Boissard and other accoucheurs in Paris. There are two kinds of Consultations de Nourrissons. Those of the type established by Budin are attached to the maternity hospitals, and are limited to the children born in the hospital. The women are admitted for confinement free of charge, and the children born in the hospital are kept under regular medical supervision for the first two years. Every effort is made to encourage breast-feeding, but where satisfactory evidence can be adduced that this is impracticable the children are fed on sterilized milk supplied daily at the hospital. Each mother is required to bring her child once a week to the hospital, where it is examined by one of the medical staff. The weight is taken and periodically entered with other particulars in a register. The sterilized milk for the hand-fed



THE "GOTA DE LECHE," MADRID.
Dr Rafael Ulecia Y Cardona examining the children.

children is supplied daily in bottles, each bottle containing sufficient for one meal and no more, and the quantity in each bottle is prescribed by the medical man supervising the child, and is regulated by the weight of the child. Hand-feeding is exceptional at the consultations of the accoucheurs. At the Clinique Tarnier during the years 1898-1902 no less than 448 of the 527 children who were under observation were fed at the breast.¹

There are also Consultations de Nourrissons which are not attached to maternity hospitals, but otherwise the work is conducted on much the same lines. The mothers are required to bring their infants regularly for medical examination, and breast-feeding is encouraged by gifts of food and money to those mothers who suckle their children.

The Goutte de Lait, which may be regarded as the precursor and to some extent the prototype of the Infants Milk Depôts in this country, is an offshoot of the Consultation de Nourrissons, and is practically a milk dispensary from which infants are fed under medical supervision upon sterilized milk, with or without modification, supplied at the institution. Breast-feeding is encouraged, but usually the great majority of the infants are hand-fed. The Goutte de Lait, in fact, is mainly

¹ Maygrier, "Les Consultations de Nourrissons," Paris, 1903. See also two works by Prof. Budin, "Le Nourrisson" and "Manuel Pratique d'Allaitement."

intended to succour those infants for whom breast-feeding is practically impossible.¹ The first Goutte de Lait was established by Dr. Variot in connection with the Belleville dispensary, Paris, in 1892,² shortly after Budin had organised his Consultation de Nourrissons at the Charité, and there are now about fifteen of these institutions in Paris.

The first provincial Goutte de Lait, and the first to exist as a separate institution, was established in Fécamp in 1894 by Dr. Léon Dufour, who was the first to give the name of "Goutte de Lait" to these organizations. Since 1894, largely owing to the influence of Drs. Dufour and Variot, these institutions have multiplied in France, and there are now about a hundred towns provided with one or more Gouttes de Lait. The majority are conducted by philanthropic societies, assisted by subsidies from the municipality, but in some towns, *e.g.*, Nantes and Elbeuf, the Goutte de Lait is a municipal institution. In Belgium the Goutte de Lait, under the name of "Laiterie Maternelle," is also finding favour. The first Belgian Goutte de Lait was founded in 1897 in

¹ Some writers draw a sharp distinction between the Consultation de Nourrissons and the Goutte de Lait. Variot, however, applies the latter term to both organizations; but he lays stress on the difference in type between the consultations at the maternity hospitals where the infants are under medical supervision from birth, and the ordinary Goutte de Lait where most of the children are in a state of ill-health when they are first brought to the institution.

² Plate I illustrates the work of this institution.



THE "GOTA DE LECHE," MADRID.—WEIGHING THE BABIES.

Brussels by Dr. Eugene Lust (see illustration), and in 1901 an exceptionally well-appointed "Laiterie Maternelle" was opened in Hodimont by M. Jules Cerexhe (see illustrations). In Spain also, largely owing to the efforts of Dr. Rafael Ulecia Y. Cardona, the Goutte de Lait is making good progress. Dr. Ulecia's Goutte de Lait in Madrid (see illustrations) was inaugurated in January, 1904, by H.M. the Queen of Spain, and similar institutions have been established in St. Sebastian, Bilbao, and in several other towns in Spain.¹ The list at the end of this chapter indicates the progress of the movement in other countries. Most of the Gouttes de Lait in France, Belgium and Spain are conducted on the methods laid down by Dr. Dufour at Fécamp, which are described in his brochure, "Comment on crée une Goutte de Lait." The following extract from that work gives some idea of the objects and general plan of organization of the Goutte de Lait:—

The objects of the Goutte de Lait are:—

1. To induce mothers by advice and by every possible encouragement to feed their babies at the breast.
2. When it is impossible for the child to be wholly breast-fed, the mother is urged not to abandon breast-feeding altogether, but to supplement her own milk with suitably prepared cow's milk, so as to secure that the infant shall be, if not wholly, at least partially breast-fed.
3. When, however, there is no doubt that it is

¹ Ulecia Y. Cardona, "Los Consultorios de Ninos de Pecho." This book, which is illustrated by numerous photographs, describes the principal Gouttes de Lait in France and Belgium.

impossible, physically, socially, or morally, for the mother to suckle her baby, the Goutte de Lait endeavours to secure that the infant shall not lack maternal care and affection. For this purpose there is given under the best possible conditions a milk of good quality, with advice as to the conditions necessary for success in artificial feeding.

Any child in the town, in whatever state of health or of whatever social class he may be, is admitted on the application of his parents, guardians or other responsible persons.

The institution works chiefly for the sake of the poor amongst whom the difficulties of child-rearing are greatest.

The infants are distributed in three sections:—

1. Gratuitous section.
2. Half-paying section.
3. Paying section.

In the first are the poor, in the second the working people, in the third “*les bourgeois, les gens établis et les riches.*”

The infants in each of these three sections receive the same milk, prepared and distributed in the same manner. Each infant has for its sole use two numbered sets of baskets and bottles. Each mother receives every day a basket containing a number of bottles corresponding to the number of meals the infant takes during the twenty-four hours (nine). Each bottle contains a sufficient quantity of milk for one meal and no more, and the quantity is suited to the age of the child. In order to emphasise the fact that the



THE "GOUTTE DE LAIT," FECAMP.—STERILIZING ROOM.



THE "GOUTTE DE LAIT," FÉCAMP. CONSULTING ROOM.

milk is nothing more than an inadequate substitute for mother's milk, each basket is marked with the motto of the Goutte de Lait, "Faute de Mieux." The next day the basket of empty bottles is returned and a fresh supply is given out. Once a week the mothers bring the children to be weighed and examined, in order that their progress may be ascertained and controlled.

The Goutte de Lait is administered by a president and a committee of four ladies, one of whom acts as treasurer. The president, who is a medical man, is charged with the general supervision of the work, the control of the preparation of the milk, the cleansing of the bottles, weighing the babies, &c. The ladies collect the subscriptions and take charge of the funds of the Goutte de Lait.¹

At Fécamp the milk is modified by the addition of water in the proportion of one part of water to two parts of milk, and to each litre of the mixture is added 15 grams of centrifugalised cream, separated on the premises, 35 grams of lactose and 1 gram of common salt. After modification the milk is bottled and kept at a temperature of 102°C. for three-quarters of an hour.

The same modification and method of sterilization is in use in most of the Gouttes de Lait in the French provincial towns and in Belgium.

In the Havre Goutte de Lait and in those in

¹ Dufour, "Comment on crée une Goutte de Lait, Fécamp," 1902; "La Goutte de Lait à Fécamp," Rouen, 1900.

Paris, however, the milk is sterilized but not modified, while in the Gouttes de Lait at Saint-Pol-sur-Mer, Châlons-sur-Marne and Beauvais the milk is unmodified and pasteurized.

In all the Gouttes de Lait, except those attached to the dispensaries in Paris, each meal is supplied in a separate bottle; in some of the latter institutions, however, the milk, sterilized "industriellement" in the country, is supplied in litre or half-litre bottles, the mother being given a small graduated bottle with instructions as to the proper quantity for each meal.¹

The degree of control exercised over the milk supplied to these institutions varies. At Saint-Pol-sur-Mer, where, thanks to the generosity of M. Van Cauwenberghe, the Goutte de Lait has been organised on most admirable methods, the cows are owned by the institution, the milking is carried on under aseptic precautions, and the milk is pasteurized immediately after being drawn from the cow.

The cows supplying the Rouen Goutte de Lait are kept in a model cowshed in the country, the milk is sterilized immediately after milking, and it is then conveyed to the city in special wagons².

In many other instances the source of the milk supply is under supervision, but on the whole it may be said that, with certain exceptions, the

¹ Dr. Marguerite Margouliès, "La Goutte de Lait," Thèse de Paris, 1903.

² "Une Vacherie modèle annexée à la Goutte de Lait de Rouen," *La Clinique Infantile*, January 15th, 1904.



THE "LAITERIE MATERNELLE," HODIMONT.

control of the milk supply is not so stringent as it might be.¹

Although a sharp distinction cannot be drawn between the Consultation de Nourrissons and the Goutte de Lait, yet in practice it is found that the two institutions fulfil somewhat different functions. In the former, the mother is encouraged by persuasion, and, if necessary, by pecuniary inducements to suckle her child. In the latter, although breast-feeding is encouraged, the work is carried on chiefly for the sake of those children for whom breast-feeding is impracticable. The consultations attached to the maternity hospitals have exceptional advantages. The infants from birth are under skilled medical supervision, and it is not surprising that the results are more striking than those of the Goutte de Lait, where most of the children are already ill when they first come to the institution, and are, indeed, often brought because of their ill-health. Both the Consultation de Nourrissons and the Goutte de Lait are alike, however, in that the chief feature of the work is the systematic medical supervision of the children. In many of these institutions (but not in all) the milk is only supplied on the condition that the child is

¹ In Dr. Raimondi's Pourponnière at Versailles (which, however, is a crèche, not a Goutte de Lait) the cows are kept on the premises, and are milked four times a day, so that the babies have milk as fresh as possible. Before milking, the cows' udders and the milkers' hands are disinfected with corrosive sublimate solution, 1—1000.

brought up once a week to be weighed and examined by the doctor who presides over the institution. It is in the matter of medical supervision that the chief difference lies between these French institutions and those described in the next chapter.¹

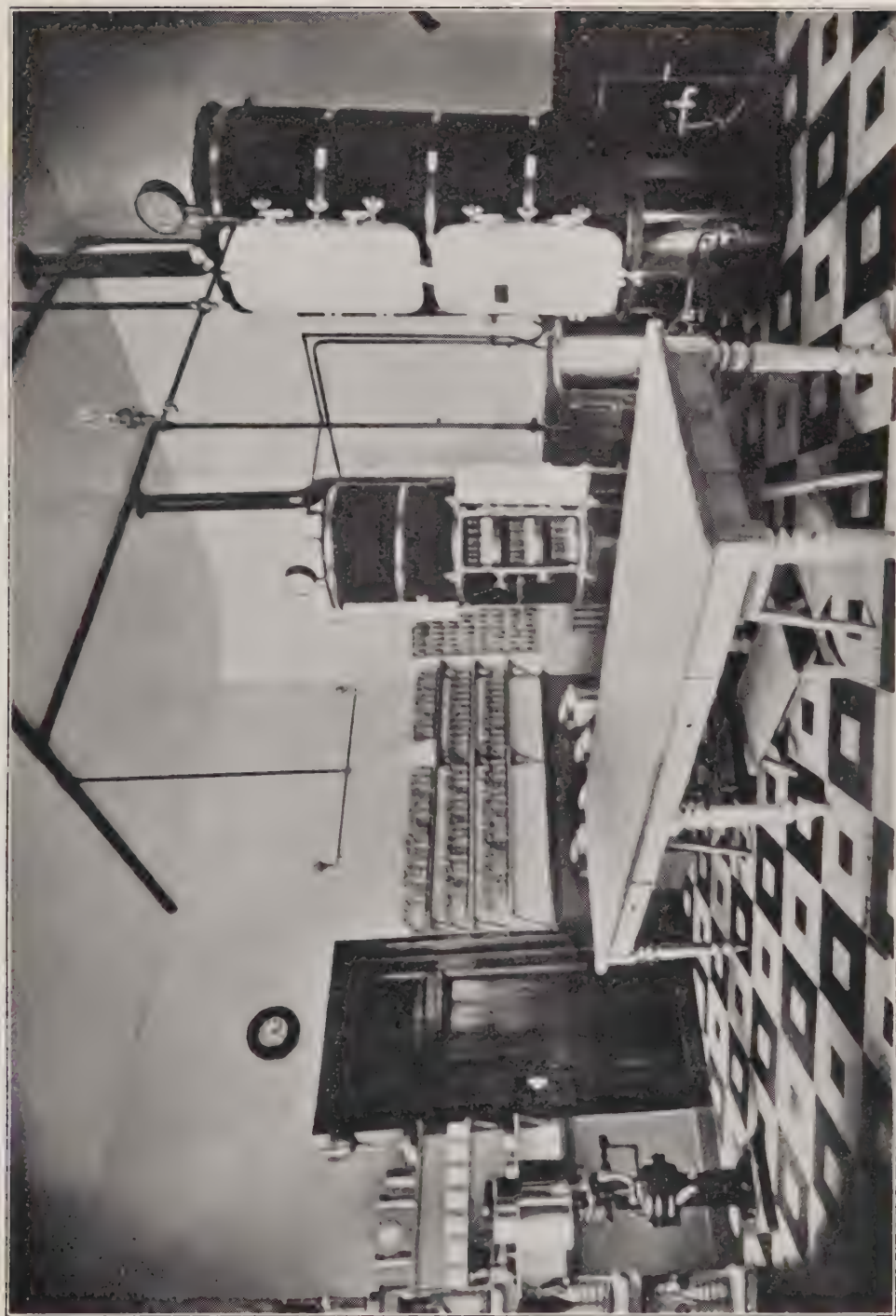
¹ Dr. Dufour has kindly supplied the writer with the following list of towns in which Gouttes de Lait are either actually established or projected :—

France, as follows:—Aix, Albert (Somme), Alger, Alençon, Amiens, Alfortville, Angers, Annonay, Arques, Appoigny, Auzeville par Cartenay, Avignon, Barentin, Bar-le-Duc, Bellevue (Seine), Besançon, Bethinie, Bolbec, Bordeaux, Bourgoin (Isère), Biarritz, Bléville (près de Le Havre), Beauvais (Oise), Boulogne-sur-Mer, Boulogne, Bourg, Blois, Brest, Caen, Cahors, Castres, Cambrai, Chateaufort (Nièvre), Châlons, Châtellerauld, Cherbourg, Courbevoie, Clermont-Ferrand, Deville-les-Rouen, Dijon, Dunkerque, Elbeuf, Epernay, Fécamp, Granville, Gurgy, Jouy-en-Josas, Le Havre, Le Mans, Lille, Lillebonne, Lens, Louviers, Les Ponts-de-Cé (Maine-et-Loire), Labrosse (près Auxerre), Lorient, Melun, Marseille, Moulins, Montauban, Nantes, Nancy, Nice, Orléans, Pantin, Paris, Poitiers, Guingamp, Rouen, Reims, Rennes, Roanne, Roubaix, St. Brieux, St. Ouen, Sens, Saumur, Sarlat, Saint-Just, Saint-Nazaire, Saint-Martin-Vésubie, Saint-Pol-sur-Mer, Saint Germain-en-Laye, Tours, Toulon, Toulouse, Tourcoing, Versailles, Valence, Vinsobres (Drôme), Youlins.

Other European Countries, as follows :—Antwerp, Athens, Battersea, Berlin, Bucharest, Bigheur (Belgium), Brussels, Barcelona, Bilbao, Bradford, Charleroi, Cadiz, Crasiova (Roumania), Covilhan (Portugal), Düsseldorf, Dundee, Florence, Gand, Geneva, Glasgow, Halle, Hodimont, Königsberg, Leith, Lisbon, Liverpool, Lozen, La Haye, Lausanne, Mannheim, Madrid, Mous, Milan, Naples, Odessa, Pfozheim (Baden), Portbou, Portalégre, Rome, St. Sebastian, Sarrogoissa, St. Petersburg, Stockholm, Schwobgmund, Saint Helens, Temesvar, Turin, Varna (Bulgaria), York, Zurich.

America:—Buenos Ayres, Santiago, Montevideo, Montreal, Chicago, New York, Philadelphia, Rochester.

Africa:—Algiers, Canary, Constantine.



THE "LAITERIE MATERNELLE," HODIMONT.—STERILIZING ROOM.



THE "LAITERIE MATERNELLE," HODIMONT.
CONSULTING ROOM.



THE "LAITERIE MATERNELLE," HODIMONT.
WAITING ROOM.

CHAPTER VI.

THE INFANTS MILK DEPÔT.

WE have seen that the object of the Goutte de Lait is to prevent the heavy infantile mortality which is the result of improper infant feeding. It was for the same object that a public supply of specially prepared infants milk was established in 1893 in New York City by a well-known philanthropist, the Hon. Nathan Straus. At that time the infantile mortality of New York was very heavy, and after much study of the subject Mr. Straus concluded that the most effectual method "was to place milk suited for infant nutriment within reach of the poor."

"After making a thorough examination of the subject, and taking counsel with physicians both at home and abroad, I began to experiment in 1893 with one milk depôt. More than a thousand sick babies were fed on the pasteurized and modified milk preparations, as to whose necessity for infant food I found medical testimony absolutely unanimous. Most of the children were ill with cholera infantum, and the benefit due to the improvement in their food was immediate and amazing. . . . The first year's experience showed me that the indirect results of my efforts were quite as valuable as those that could be directly traced to them. The standard of quality of

the milk supply of the poor had been raised within the whole area adjoining my depôt, the people being quick to discern the superiority of an article furnished at a low price over the more or less tainted and also more costly one they had been accustomed to use. During the hot term, I also sold milk in its natural state at a cent a glass, in booths which I was permitted to erect in the public parks. The visiting physicians of the Board of Health and all physicians doing charitable work among the poor have been, from the beginning of my work, supplied by me with all the pasteurized and modified forms of milk which they required, free of expense. It has been my effort from the first to have the milk sold at my dépôts so drawn, handled and transported as to reduce to a minimum the chances of pollution. The milk is cooled thoroughly before shipment, kept cool in the process of transportation, and on arrival at New York is at once taken to the main laboratory and placed on ice preparatory to being turned into the bottles to go through the process of pasteurizing. Before this, however, it is run through a separator for the purpose of freeing it from all mechanical impurities. It has been a rigidly observed rule that, without respect to demand, no bottle of pasteurized milk should be sold twenty-four hours after its preparation.”¹

Mr. Straus’ first depôt is thus described by Dr. Freeman :—

“ This milk depôt was located on a pier at the foot of East Third Street, that situation being accessible to a very large tenement-house population. Awnings and seats were put up on the pier so that the babies and their mothers could remain there and inhale the fresh air from the river.

“ The building which was erected was, owing to the

¹ Straus, “ The Influence of a Pure Milk Supply on the Death-rate of Children,” New York, 1897



THE "LAITERIE MATERNELLE," HODIMONT.
MILK DISTRIBUTING ROOM.



THE "LAITERIE MATERNELLE," HODIMONT.
BOTTLE-WASHING ROOM.

character of the site, of necessity long and narrow; it was placed several feet from the edge of the pier, so that an outside passage-way connecting the rooms was reserved. The building was divided into four rooms. The first room is used for sterilizing the bottles, stoppers and nipples, and preparing and pasteurizing the milk. The second room is occupied by large water-baths of iced water for keeping the pasteurized milk until it is delivered. The third room contains ice-boxes for the cans of raw milk. The fourth room, which is nearest the end of the pier, is devoted to the business of selling the milk.”¹

In the Straus Milk Charity the milk is pasteurized, not sterilized, as in the French dépôts. It is heated in stoppered bottles to 167° F. (this temperature is reached in about ten minutes), and remains at that temperature for twenty minutes.

“At first two sorts of milk were furnished :
(1) pure milk pasteurized in eight-ounce bottles;
(2) a milk especially prepared for feeding infants, a one-half dilution with water, sugar of milk and lime-water as follows :

Sugar of milk, 12 oz.
Milk, 1 gal.

Lime-water, 8 oz.
Water, 1 gal.

thus producing about what we now speak of as 2.2.7, that is 2 per cent. fat, 2 per cent. proteids, and 7 per cent. sugar. This formula was not considered ideal, but was easily prepared and seemed to answer well. It was dispensed in eight-ounce bottles.

“Later, on the advice of Dr. A. Jacobi, there was added a one-half dilution of milk with barley-water,

¹ Rowland G. Freeman, “The Straus Milk Charity,” New York, 1895.

which was sweetened with cane-sugar according to the following formula :

Table-salt, $\frac{1}{4}$ oz.
Milk, 1 gal.

White cane-sugar, 10 oz.
Barley-water, 1 gal.

This was dispensed in six-ounce bottles.

"The six-ounce bottles of both the prepared milks were sold at one cent each. The eight-ounce bottles of pure milk were sold at one and a half cents each."¹

Mr. Straus endeavours to obtain as pure a milk supply as possible. The milk is certified by the New York Milk Commission, and the farms and cows from which it is derived are inspected by the Veterinarian of the New York Board of Health. The milk is cooled immediately after being drawn from the cow, and is kept in ice until it is pasteurized. In 1902 the Straus Milk Charity had fourteen depôts at work in New York, and 1,200,000 bottles of milk were supplied.²

Similar depôts have since been opened in Brooklyn, Philadelphia, Yonkers, N.Y., Chicago, and Rochester, N.Y. In all these depôts the milk was pasteurized at first, but in the Rochester depôt, which is a municipal institution, it has been found possible, by the observance of strict cleanliness in milking and storage, to dispense with any process of sterilization or pasteurization, and the milk is supplied raw. A fuller account of the Rochester

¹ Freeman, "Milk Pasteurization," New York, 1897.

² Freeman, "The Reduction in the Infantile Mortality in the City of New York," *Medical News*, New York, September 5th, 1903.



INFANTS MILK DEPOT, EARLE ROAD, LIVERPOOL.

methods, which are of the greatest interest, is given later.

The first infants milk dépôt in this country was opened on August 8th, 1899, by the St. Helens Corporation, on the initiative of Dr. F. Drew-Harris, the Medical Officer of Health.¹ Dépôts were opened by Liverpool, Ashton-under-Lyne and Dukinfield in 1901, Battersea in 1902, Leith and Bradford in 1903, and Burnley, Glasgow and Dundee in 1904. All these are municipal institutions, but the first private dépôt in this country was established in 1903 by the York Health and Housing Association, at the instance of Mr. Seebohm Rowntree, and in November, 1904, a dépôt was opened in Finsbury, by the Finsbury Social Workers' Association, on the initiative of Dr. George Newman.² In Liverpool the work is conducted on a large scale. There are two sterilizing stations, and during the two and a half years ending December 31st, 1903, no less than 6,295 children had been fed on the milk.

As the British milk dépôts differ in some respects from the French Gouttes de Lait and from the American dépôts, it may be useful to describe the working of one of the former institutions in some detail, and for this purpose the

¹ *The British Medical Journal* of August 18th, 1900, contains an interesting article by Dr. Drew Harris on the St. Helens Dépôt.

² The Finsbury dépôt is unlike the other British dépôts in several important respects. It is conducted more on the lines of the Goutte de Lait. See p. 125.

writer has selected the Battersea dépôt, as being the one with which he is most familiar. It may be taken as a fairly typical infants milk dépôt. The following description applies to the methods adopted at the present time, which are the results of over two years' experience.

The first question to be considered in the organization of a milk dépôt is the control of the milk supply. When a sanitary authority undertakes to supply milk for infants, a serious responsibility is incurred, and it is important that the source of the milk supply should be subject to the strictest possible control. It is true that the process of sterilization destroys the bacteria in the milk,¹ but sterile milk is not necessarily non-toxic; the dead bodies of the bacteria remain, and no amount of cooking will make a dirty milk clean. In the working of the Battersea dépôt care is taken to safeguard the milk from pollution before it reaches the dépôt. The farm from which it comes was selected by the Medical Officer of Health from a number of farms offered by the contractor, the cows were inspected by a veterinary surgeon and certified to be free from tuberculosis after the application of the tuberculin test. The cows are milked in the open air, and never enter a shed except for a few weeks in January and

¹ Drs. Robertson and Mair have shown that the sterilizing process usually adopted cannot be relied upon to render the milk absolutely sterile in all cases. ("On the Bacteriology of so-called 'Sterilized Milk,'" *British Medical Journal*, May 14th, 1904.)



INFANTS MILK DEPOT, BATTERSEA.—DISTRIBUTING ROOM.

February. The milk is strained in the field immediately after milking, and is then sent to a creamery half a mile from the farm. Here it is again strained, and at once cooled down to 40° F. It is then placed in churns which are sealed with a leaden seal, and is conveyed in these churns to the dépôt.

The following is a list of the conditions accepted by the contractor:—

1. The contractor shall supply milk which must contain not less than 3·25 per cent. of butter fat, and 8·75 per cent. solids not fat, and cream which must contain not less than 50 per cent. of butter fat; and the milk and cream must be free from chemical preservatives or colouring matter, and be drawn from healthy cows only.

2. The contractor shall deliver the milk and cream in sealed churns or cans to the Council's Dépôt, No. 28, York Road, before 8 a.m. every morning, Sunday excepted.

3. The contractor must be prepared to increase or diminish the supply within reasonable limits at one day's notice from the Medical Officer of Health.

4. A warranty ticket must be attached to every churn and can guaranteeing its contents to be in accordance with the specification.

5. No charge is to be made for the use of churns or cans, which when empty are to be removed by the contractor from the Council's dépôt free of charge.

6. All pails, strainers, railway churns, refrigerators, fittings and other vessels and implements brought into contact with the milk shall be thoroughly inspected before being used, be properly cleansed, scalded and dried immediately after being used, and exposed to the air in a clean place, without lids or covers.

7. The farms, water supply, drainage system, farm buildings, dairy and cattle shall be open at any reasonable time to the inspection of the Council's Medical Officer of Health, or any person duly authorised by him, and no milk or cream shall be supplied from any farm which has been certified by the said Medical Officer of Health to be in an insanitary condition.

8. The cows shall be subject, if required, to a periodical veterinary inspection by a Veterinary Surgeon duly appointed by the Council, and the contractor shall undertake not to supply milk or cream from any cow which is diseased, newly calved, or under physic.

9. The cows shall during summer be pastured, and during winter so fed that no taint is imparted to the milk. The contractor undertakes to use no brewer's grains (wet or dry), turnip-tops or vetches.

10. The udders of the cows shall be carefully cleansed before milking, and the utmost possible cleanliness observed at every point connected with the cows, cowhouse, utensils and attendants.

11. The milk shall be carefully strained and cooled to at least 56° F. immediately after milking, over a Lawrence or other cooler of approved design, and shall be delivered at the Council's Milk Dépôt at a temperature not higher than 56° F.

12. The contractor shall undertake that the refrigerators and the in-flow and out-flow pipes, etc., are examined daily in order to see that everything is in thorough repair, and that there is no leakage.

13. No milk or cream shall be supplied from any farm on which there is a case of infectious disease.

14. The Council shall have the right to take samples of the milk or cream at any time, either at the farm or at any point in course of delivery.

15. From June to September inclusive, the contractor, when required by the Medical Officer of Health, shall pasteurize the milk before delivery.

16. Should any breach of any one or more of these clauses be at any time proved, the contractor shall pay to the Council the sum of twenty pounds, or any lesser sum the Council may think fit, as and for liquidated damages, for each and every time such breach of any clause shall have been committed, and the Council shall deduct the same from any amount which may be due to the contractor.

The Battersea dépôt is a three-storied building which was adapted for the work. The two upper stories are occupied as a residence by the manageress and some of the staff, and the work is carried on in four rooms on the ground floor. The front room is used as a shop, in the next room the babies are weighed, the third is the bottle-washing room, and in the fourth the processes of modifying, bottling and sterilizing are carried out. The appliances in use are as follows:—

1 one-h.p. boiler.

1 Sterilizing chamber with trolley, as shown in the Plate opposite this page.

2 Bottle-filling machines.

1 Cold-storage chamber.

1 Cooling tank.

1 Electric motor, to which are attached two revolving brushes for bottle-washing.

3 Soak tanks for dirty bottles.

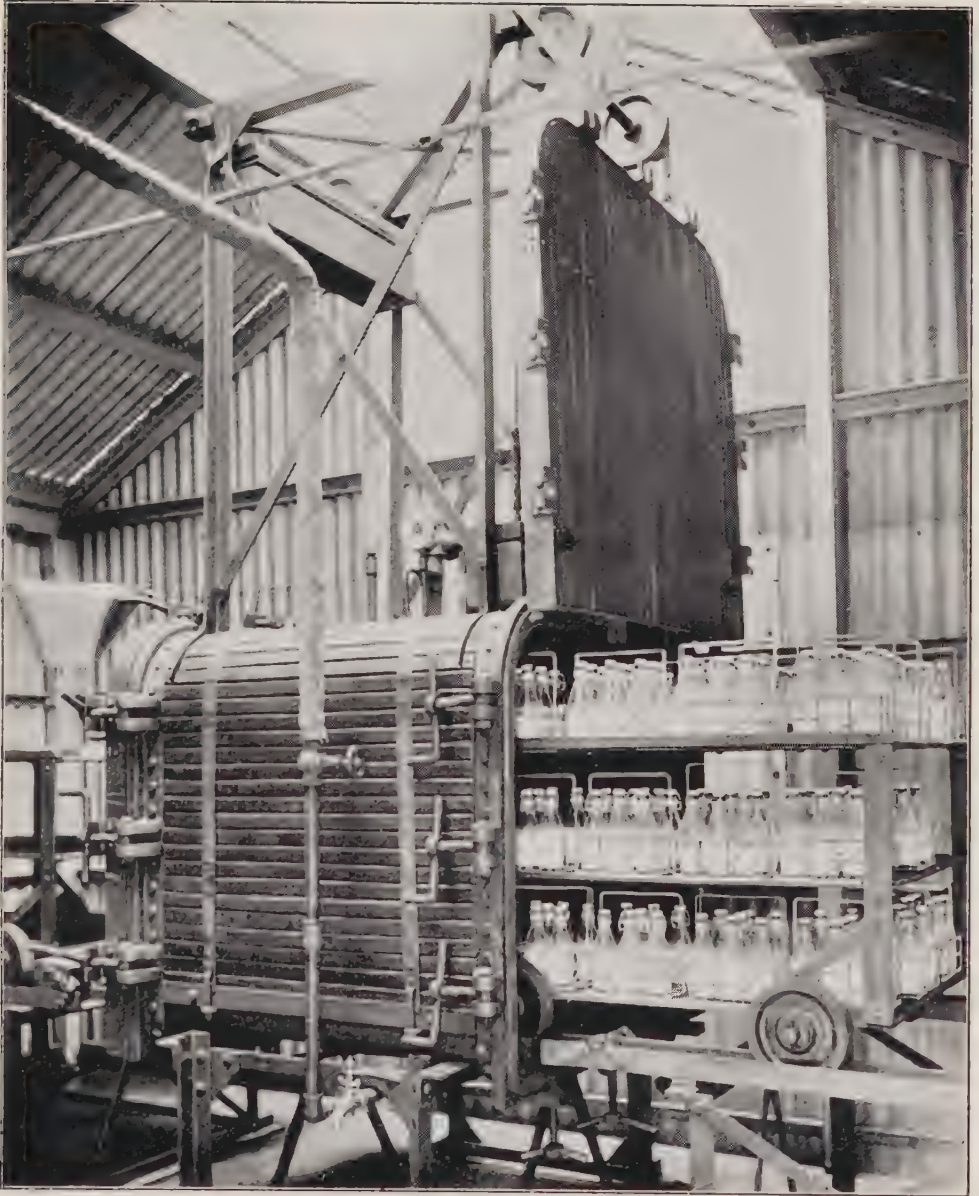
3 Sets of rinsing jets.

1 Milk strainer.

Draining racks, churns, cans, measures, wire baskets, graduated 7 oz. bottles, etc.

The amount expended in alterations to premises and in appliances since the dépôt was opened in June, 1902, is about £700.

The milk arrives at the dépôt about 6 a.m. It is carefully strained through a Ulastrainer, and is then (for infants under six months) modified by the addition of water, cream, sugar and a little



INFANTS MILK DEPOT, BATTERSEA.—STERILIZING CHAMBER WITH
LOADED TROLLEY.

salt. The following table gives the dilutions and the amounts given at different ages:¹—

Age of Child.	Modification.	No. of Bottles per Day.	Amount per Bottle.	Amount per Day.
During 1st fortnight	Milk 1 part, water 2 parts ...	9	1½ oz.	13½ oz.
" 2nd "	" "	9	2½ "	22½ "
" 2nd month	" "	9	2½ "	22½ "
" 3rd "	Milk 1 part, water 1 part ...	9	3 "	27 "
" 4th "	" "	8	4 "	32 "
" 5th "	Milk 2 parts, water 1 part ...	7	5 "	35 "
" 6th "	" "	7	5 "	35 "
" 7th "	Milk unmodified ...	6	6 "	36 "
" 8th "	" "	6	6 "	36 "
Over 8 months ...	" "	6	7 "	42 "

It will be seen that children over six months receive unmodified milk. At first these children received the third modification, but since the spring of 1904 unmodified milk has been given, and the change has been distinctly beneficial.

Cream and sugar are added to the modified milk, so as to bring the proportion of fat and sugar to about 3·2 and 6 per cent. respectively. The milk is varied to suit individual cases upon the request of a medical man. After modification the milk is

¹ The dilutions and amounts originally given were based on the table in the leaflet, "How to Bring Up Children," issued by the Medical Committee of the Hospital for Sick Children, Great Ormond Street.

bottled and is then, the stoppers being closed, placed in the sterilizing chamber. Steam is injected and the temperature raised to 212° F., where it remains for from fifteen to thirty minutes. The bottles are then taken out of the sterilizer and rapidly cooled in the cooling tank.

The bottles are supplied in wire baskets, each basket holding from six to nine bottles and containing a twenty-four hours' supply. The next day the basket of empty bottles is returned and a fresh supply obtained. In the winter the supply for Sunday is given out on Saturday, but in summer it is prepared on Saturday evening and supplied the following day.

Before a child begins to be fed from the dépôt the mother is warned that the milk is nothing more than a poor substitute for mother's milk, and that it should not be used unless breast-feeding is absolutely impossible. This caution is repeated by the lady inspector who visits the homes of the children fed on the milk. When the child begins to be fed on the milk certain particulars are entered in the register. These particulars include the child's name, age, address and state of health, and the name of the medical man who advised the use of the milk. A record of each child is kept, and the milk is varied from time to time as the child grows older.

When a child is entered at the dépôt the mother is instructed by the manageress as to the proper

PLATE XIV.



INFANTS MILK DEPOT, BATTERSEA.—BOTTLE-FILLING.

method of using the milk, and she receives the following printed leaflet :—

INSTRUCTIONS FOR THE USE OF HUMANISED MILK.

1. The charge for the full weekly supply of Humanised Milk for infants under six months is 1s. 6d., payable in advance. If a day's supply only is taken, the charge is 3d. The charge for the full weekly supply for infants aged from six to twelve months is 2s., or 4d. per day. Children above one year old will be charged 2s. 6d. per week, or 5d. per day. The scale of charges for children living outside the Borough is as follows :—

Under six months	...	2s. 3d. per week, or 4d. per day.		
Six months to twelve months	...	2s. 9d.	„	5d. „
Over one year old	...	3s. 3d.	„	6d. „

2. The Dépôt is open from 11 a.m. to 6 p.m. on week-days, and is closed on Sundays.

3. The milk will be supplied in bottles in a basket, each bottle containing sufficient milk for one meal, the amount varying with the age of the child. Infants under two months receive nine bottles per day; older children receive fewer bottles, as they should be fed less frequently.

4. If children are sent for the milk, they must be warned not to tamper with the stoppers of the bottles. On no account must a bottle be opened until the infant is ready to be fed.

5. Just before using, each bottle should be placed unopened in a basin or jug of hot water, and warmed to the proper temperature. The bottle should then be opened and the teat put on. The child should be fed at regular intervals, and fed from these bottles only. On no account should any other feeding-bottle be used. The teat should be kept scrupulously clean.

6. When all the milk in one bottle is not used, the remainder must not be warmed up again, but a fresh bottle opened for the next meal. Where there are other children this milk need not be wasted.

7. On no account should any other food be given unless ordered by a doctor.

8. After using, the bottles should be thoroughly rinsed in cold water.

9. Breakages will be charged for at the rate of 1*d.* per bottle, and damage to baskets must be made good. All bottles, baskets and rubber rings not returned to the *Depôt* will be charged full value.

10. It is important that the child should be brought once a week to be weighed. The *Depôt* is open for this purpose on Tuesdays and Wednesdays from 2.30 to 4 p.m.

11. The presence of Infectious Disease in a house must be at once notified to the Medical Officer of Health.

N.B.—The milk should never be used in preference to mothers' milk, which is the best of all foods for young infants.

PLATE XV.



INFANTS MILK DEPOT, BATTERSEA.—BOTTLE-WASHING.

The bottle is placed on a revolving brush driven by an electric motor.

It will be seen that this method of infant feeding is a very simple matter as far as the mother is concerned. When feeding time arrives all she has to do is to place the bottle, unopened, in a basin of warm water until it reaches body temperature, to open the bottle, put on a rubber teat supplied at the depôt, and feed the baby from the sterilized bottle direct. There is no need for a "feeding bottle," which alone is a great advantage.

The homes of the children fed on the milk are visited by the lady sanitary inspector, who endeavours to secure that the instructions are properly carried out. At the time of her visit the inspector fills up a printed form, which is submitted to the medical officer of health. This form is reproduced on p. 82. If the child does not appear to be progressing favourably the mother is strongly advised to seek medical advice, and if the child has been using the milk for more than a few weeks and is not under medical supervision the mother is advised to give a little fruit juice in addition to the milk. The mothers are supplied with cards for recording the child's variations in weight, and they are urged to bring the children once a week to be weighed, but it has been found impossible to insist on this. There appears to be a prejudice against baby-weighing; at all events the number of children who are brought to the depôt for this purpose is comparatively small.

BATTERSEA BOROUGH COUNCIL.

REPORT ON CHILD FED ON COUNCIL'S MILK.

Name_____Address_____

Age on admission_____Date of admission_____

Recommended to Dépôt by Dr._____

Circumstances of child's people_____

Are the child's people clean?_____

Do the parents think the child is thriving on the milk?_____

Has the child gained weight since using the milk?_____

Present health of child_____

Health of child on coming to Dépôt_____

How was the child fed before using the milk?_____

Was the child breast fed?_____For how long?_____

What is done with the milk, if any, left by the child?_____

Is any other food given in addition to the milk?_____

Has the milk ever been sour?_____

Are the bottles probably opened before time of feeding?_____

No. of children in family_____

Why was breast feeding discontinued?_____

Is the milk poured into another bottle?_____

Warmed?_____

If so, what kind of bottle?_____

How is the teat cleaned?_____

Why was the milk discontinued?_____

Date of death_____Cause of death_____

Date of visit_____

_____Sanitary Inspector.



BOTTLES OF MILK SUPPLIED AT THE LIVERPOOL MILK DEPOTS, SHOWING THE DIFFERENT QUANTITIES SUPPLIED TO CHILDREN AT DIFFERENT AGES.

Arrangements have been made with the Board of Guardians by which the relieving officers are empowered to issue orders on the depôt in lieu of giving money in outdoor relief. Similar arrangements have been made with various local charitable organizations.

In the depôt at Earle Road, Liverpool, which is the most complete in this country, the milk is kept at a temperature of 210° F. for from 20 to 30 minutes, and the preparations are as given below.¹

Age.	Quantity of Pure Milk for 24 Hours in Ounces.	Water in Ounces.
1—2 weeks ...	$6\frac{3}{4}$	$6\frac{3}{4}$
2—8 „ ...	$13\frac{1}{2}$	$13\frac{1}{2}$
2—3 months ...	$20\frac{3}{4}$	$10\frac{3}{4}$
3—5 „ ...	30	15
5—7 „ ...	36	12
Over 7 months...	36	12

$2\frac{1}{2}$ ounces of cream, $1\frac{1}{2}$ ounces of sugar, and $\frac{1}{6}$ ounce of salt, to be added to each gallon of mixture.

It will be seen that there are important differences between the British and American depôts and the French Gouttes de Lait, the most important being those in connection with the supervision of the children. In most of the French institutions the supply is stopped if the

¹ Mussen, "Supply of Sterilized Humanized Milk for Infants," *Journal of State Medicine*, October, 1903.

child is not brought to the dépôt regularly to be weighed and examined by a medical man; but in the British and American dépôts there is no hard and fast rule of this kind, and such supervision as is exercised by the officers of the dépôt is carried out by nurses or lady inspectors acting under the instructions of the medical director of the institution, who in this country is the Medical Officer of Health. As a matter of fact, most of the children come to the dépôt on the advice of a doctor, and begin the milk under medical supervision, and should the progress of the child at any time be unsatisfactory, a fact which the parents are by no means reluctant to bring to the notice of the management, the mother is strongly advised to take the advice of her own doctor. In the British dépôts the object is to secure as far as possible the supervision of the regular medical attendant, rather than to appoint a municipal doctor to give gratuitous advice. It is questionable whether the latter plan would meet with the approval of the medical profession in this country, as it is easy to see that it might lead to what is known as "hospital abuse."

Still it must be admitted that in this respect the methods of the British dépôts are not wholly satisfactory. The usefulness of the dépôt would be much increased if a consultation formed part of the organization, as in the *Goutte de Lait*, especially if the consultation were open to nursing mothers. In this way the dépôt could be made a

PLATE XVII.



INFANTS MILK DEPOT, BATTERSEA:

A 24 hours' supply for a baby over 8 months old. Each bottle contains 7 ozs. of unmodified milk.

nucleus, not only of a Consultation de Nourrissons, but also of a more extended organization for the encouragement of breast-feeding. Such an organization, including religious and social workers amongst its active members, should be established in every district. What we have to aim at in infant feeding is the encouragement of breast-feeding, not the distribution of cow's milk, which should be regarded as nothing more than a regrettable necessity. In the encouragement of breast-feeding we have much to learn from the French, who are far ahead of us in this, as in most matters relating to the care and rearing of young children.

It cannot be said that the control of the milk supply in the British depôts is wholly satisfactory, for it may be questioned whether a Sanitary Authority is justified in supplying milk the production of which has not been supervised "from the cow to the consumer" by the responsible officers of the authority. If the organization of the British depôts included the ownership of the cows it would be possible to improve on the present methods by modifying, bottling and sterilizing the milk on the farm immediately after milking, or, better still, by the adoption of aseptic methods of milking and cold storage, to supply the milk uncooked as is done at the municipal depôt at Rochester, U.S.A. This subject is discussed at greater length in Chapter VIII.

CHAPTER VII.

RESULTS.

FROM the foregoing considerations it is evident that the existence of the Consultation de Nourrissons, the Goutte de Lait, and the Infants Milk Dépôt can be amply justified from the general principles of pathology and hygiene. We may now proceed to examine the results of these institutions, so far as they can be ascertained at the present time. A considerable amount of statistical matter has been issued concerning the various dépôts in Europe and America, but after a careful consideration of the numerous documents the writer has been able to consult he has arrived at the conclusion that it is doubtful whether the value of these institutions can be expressed in figures. But there are very many other preventive measures of which this can be said. There are, indeed, few measures of public health administration whose beneficial effect can be demonstrated inductively by statistics, as can be done in the case of vaccination. The conditions determining the prevalence and fatality of a particular disease or group of diseases are so exceedingly numerous and interdependent that it is almost impossible to trace the effects of any one cause. For instance, the

precise effect of hospital isolation on the prevalence and fatality of any of the chief infectious diseases is most difficult to determine, although a considerable mass of material is available for analysis. To trace the effect of a milk depôt is a much more difficult problem. From the statistical standpoint a depôt is analogous to a hospital for sick children. It would be an extremely difficult task to estimate in figures the influence on child mortality of the various children's hospitals in London; and in the case of the milk depôt the difficulty is even greater, as the few depôts which exist at the present time have been but recently established, and in every case the operations have been conducted on a comparatively small scale. In this, as in most medical questions, clinical testimony is of far greater value than statistics, and this testimony is almost uniformly favourable to the depôts. In Battersea this is certainly the case. In February, 1904, the writer addressed a circular letter to the medical practitioners in the district and to the visiting physicians of certain children's hospitals to which Battersea children are taken, asking for an expression of opinion as to the value of the milk. Replies were received from forty-four practitioners, three of whom refrained from expressing any opinion on the ground that they had not had sufficient data. The remaining replies, with one exception, were favourable, in most cases highly so; only one practitioner expressed himself as disappointed with the results obtained from the use of the milk. In May, 1903,

the South-West London Medical Society passed, unanimously, a resolution approving the action of the Battersea Borough Council in establishing the dépôt. The testimony in favour of the Straus dépôts of the observers who conducted what was probably the most methodical and extensive investigation into infant feeding yet made is quoted on pages 107—108.

The statistical evidence, it must be confessed, is uncertain. All the methods which have yet been employed are beset with fallacies, which in no case appear to have been successfully avoided.

The method usually adopted is to compare the death-rate amongst the children fed from the institution with the infantile mortality in the town. Professor Budin recently presented a report to the Académie de Médecine, Paris, on the work of his Consultation de Nourrissons at the Clinique Tarnier. From the account of this report in the *British Medical Journal* of February 20th, 1904, it appears that since March, 1898, 712 children have attended the consultation from birth for periods varying from less than one month to two years, and that 26 died; a proportion of 36·5 per 1,000. As the average period of attendance was nine and a half months, the annual mortality rate is estimated at 46 per 1,000. For comparative purposes it is stated that in Paris during 1898, 1899, 1900 there were 20,282 deaths in 113,805 infants under one year, deducting the infants sent to nurse outside the city, or a proportion of 178 per 1,000—a

figure which compares most unfavourably with the mortality rate at the Clinique. But these figures are not really comparable; for while the rate in the city is a death-rate of infants under one year, no less than 243 of the 712 children at the Clinique attended during their second year—a period when the mortality rate in Paris is one-half that in the first year. It would be better either to exclude these 243 children, or to compare the rate 46 per 1,000 with the death-rate in Paris of children under *two* years.¹

In the comparative figures calculated for the St. Helens Dépôt by Dr. Drew Harris, the results appear to have been calculated on the number of children under one year. The figures are as follows:²—

Year.	No. of Children on Books.	Death-rate per 1,000 among Children at Dépôt.	Infantile Death-rate, Borough of St. Helens.
1899	232	103	157
1900	332	102	188
1901	282	106	175
1902	200	82	167

¹ The difference between the two rates, however, is much too great to be explained by the difference in age-periods. There can be no doubt that the children at the Clinique had a much better chance of survival than children living under average conditions in Paris, although this cannot be expressed numerically from the data given. The 712 children were all born in the institution, nearly all were breast-fed, and all were under the supervision of one of the most distinguished of living physicians.

² "Annual Report on the Health of St. Helens," 1902.

In the first three years of this table the children fed on the milk for less than one week were deducted, as in these cases the milk was not given a fair trial; in 1902 the children fed for less than fourteen days were deducted.

Dr. Hope¹ has recently calculated the death-rate of the children attending the Liverpool depôts. The total number of children on the books up to December 31st, 1903, was 6,295, but in many cases it was found impossible to obtain sufficient information. In the 4,453 cases kept under close observation there was a mortality rate of 78 per 1,000—a rate which compares favourably with the infantile mortality rate in the city, which was in the three years under consideration as follows:—

Year.	Infantile Mortality.
1901	188
1902	163
1903	151
	<hr/>
	Average 167·3

Adopting the same method of comparison, the writer calculated the mortality rate in the infants attending the Battersea depôt during six months, ending December 31st, 1902.² During this period there were 466 children who were kept under observation. Deducting 72 children over one year,

¹ "Annual Report on the Health of Liverpool," 1903.

² "Annual Report on the Health of Battersea," 1902.



INFANTS MILK DEPOT, LIVERPOOL.—DISTRIBUTING ROOM.

there remained 394 infants under one year, of whom 39 died. This gives a mortality rate of 98·9 per 1,000, the infantile mortality in the borough during the same period being 143 per 1,000. In 14 of the 39 fatal cases, the milk had been taken for less than one week, and when these cases were deducted and the deaths during the first week of life in the borough also deducted, the rates in the dépôt and borough respectively were 63·4 and 118·9. Similar rates have been calculated for several of the Gouttes de Lait, the results in all cases being highly favourable to the institution.

Further reflection has convinced the writer that it is most difficult to assess the value of the results obtained by the use of this comparative method. The method itself is so beset with fallacies that any results based upon it must be received with caution. In the first place, it is a mistake in this connection to treat the first year of life as one age-period. It is really a collection of age-periods, the earlier of which differ from the later in mortality rates far more than the whole first year differs from any subsequent age-period. From the infantile life-tables in the 54th Annual Report of the Registrar-General it appears that "the mortality is highest in the first day of life, and then falls rapidly, though still high in the remaining days of the first week. The mortality falls enormously in the second week, remains at nearly the same level through the third, and shows a considerable decline in the fourth week. In the second month the mortality is only

a small fraction of that in the first month ; it then falls more gradually to the end of the seventh or eighth month, after which but little change occurs."¹ If, then, the depôt children contain a greater or less proportion of infants in the first few weeks of life than the children in the town, the comparison is at once vitiated, for the age-periods are not the same. The real mortality rate, as Dr. Meredith Richards has pointed out, can only be calculated from an infantile life-table.² Moreover, a year is too long a period on which to base the mortality rate. The population attending the depôt is most numerous during the season of greatest risk, namely, the third quarter of the year, and the number of deaths, therefore, especially the deaths from diarrhœa, will be disproportionately high. It would be more satisfactory to calculate a separate rate for each quarter. Another difficulty arises from the varying periods during which the children remain on the milk. Many come to the depôt upon medical advice while suffering from some disorder, and when recovery takes place the milk is often discontinued. To include infants who have attended the depôt for not more than a week or two in the depôt population, in calculating the ordinary annual mortality rate per 1,000, is distinctly unfair to the institution. A rate should be calculated on a group of children of the same age

¹ Newsholme, "Vital Statistics."

² Richards, "Report on Infantile Mortality in Croydon," 1904.

who have attended the depôt during the whole period upon which the rate is based.

But assuming the technical statistical difficulties to be overcome, it is doubtful whether we are in a position to form a definite opinion from the results of this method. It may be urged that the mother who will take the trouble to send regularly every day for the milk may be assumed to be more than usually mindful of the welfare of her children, who would, therefore, in any case have had a better chance of survival. To some extent this is true, although the depôt method of feeding saves so much labour that it might be expected to attract the less industrious housewives. But there are considerations on the other side. In comparing the institution infants with those in the town, we are comparing a class entirely hand-fed with one containing a very large number of breast-fed infants, and it is not contended that the depôt milk is anything but an imperfect substitute for mother's milk. And while nearly all the depôt children are drawn from the poorer classes living in the least healthy districts, the town population includes the middle and upper classes, amongst whom the infantile mortality is relatively low. More important still is the fact that many of the children begin to use the milk when they are already more or less seriously ill. No less than 50 per cent. of the children attending the Liverpool depôts¹ were ill

¹ Hope, *op. cit.*

at the beginning of their attendance. The dépôt death-rate is therefore somewhat analogous to a dispensary death-rate, and the children cannot in this respect be compared with an ordinary child population. It may be that these opposing considerations neutralise each other. The writer's opinion is that the balance is distinctly in favour of the dépôts, and that the figures quoted above under-estimate rather than over-estimate the value of these institutions. But from a purely statistical standpoint this conclusion cannot be drawn from the figures as they stand. The only way of applying this method so that conclusive results might be expected, would be to calculate by an infantile life-table a death-rate in each quarter for children attending the dépôt during the whole period of observation, and for hand-fed children of the same class, living in the same district under similar conditions, and exposed to the same influences. It does not appear that such statistics have yet been published.

Another method is to compare the infantile mortality in the town before and after the opening of the dépôt. This method is employed by Dr. Peyroux, of Elbeuf, in his attacks on the Goutte de Lait.¹ Taking the nine French towns in which the oldest and most important of these institutions have been established, he has ascertained the proportion of the deaths under one year to the deaths

¹ Peyroux, "Consultations de Nourrissons et Gouttes de Lait," *La Semaine Médicale*, Paris, December 24th, 1902.

at all ages, and also the proportion per 1,000 births before and after the establishment of the Goutte de Lait. The method of estimating infantile mortality by the proportion of deaths under one year to total deaths is so fallacious that it is surprising that it should have been seriously put forward. Without considering results based on this method, we may turn at once to those calculated on the proportion of deaths under one year per 1,000 births. Dr. Peyroux' figures, which are compiled from the official returns, may be arranged in tabular form as follows:—¹

Town.	Before the Goutte de Lait.		After the Goutte de Lait.	
	Years.	Deaths under 1 year per 1,000 Births.	Years.	Deaths under 1 year per 1,000 Births.
Fécamp	1881—1894	214	1895—1900	194
Grenoble	1891—1894	168	1895—1901	141
Bourg ...	1891—1898	141	1899—1901	130
Elbeuf...	1891—1898	284	1899—1900	307
Havre ...	1891—1898	207	1899—1900	219
Nantes...	1891—1898	182	1899—1901	140
Nancy ...	1891—1899	183	1900—1901	177
Rouen ...	1891—1900	305	1901	262
Versailles	1891—1900	189	1901	180

From these figures Dr. Peyroux contends that “les résultats des Gouttes de Lait sont négatifs à Elbeuf, à Nancy, au Havre ; ils sont médiocres à

¹ In considering these figures it should be borne in mind that still-births are registered in France.

Bourg et a Versailles, un peu plus satisfaisants à Fécamp. Seules, les Gouttes de Lait de Rouen, de Grenoble et de Nantes paraissent avoir donné des résultats positifs." He will not, however, allow that the results in the latter towns are really positive. He points out that at Grenoble, for instance, in 1891—1901 the mean number of births was 1,357 per annum, while the yearly number of infants fed from the Goutte de Lait was only 72, most of whom were not fed from the institution more than three months, and he holds that the Goutte de Lait, therefore, could have had little effect in diminishing the infantile mortality. He concludes, therefore, that on the whole the results of the Gouttes de Lait have been mediocre, and for the reason that though "très scientifiques en théorie, ces oeuvres ne peuvent rien donner en pratique."

Assuming for the moment that conclusions as to the value of these Gouttes de Lait can be drawn from these figures, it by no means follows that the results have been mediocre. If the Bourg Goutte de Lait with its small *clientèle* brought down the infantile mortality in Bourg from 141 to 130 per 1,000 during three exceptionally hot summers, the promoters of that institution have good cause for congratulation. It is, however, doubtful whether any conclusions can legitimately be drawn from these figures. In the first place, as Dr. Peyroux has himself indicated, the work of the institutions has been conducted on far too small a scale to produce

an appreciable effect during the short period of observation. For instance, the total number of children fed from the Havre Goutte de Lait in 1899 was only 305, while the number of births in the town was 4,082. In 1900 the corresponding figures were 304 and 3,919.¹ The same objection would apply to any figures based on the movement of infantile mortality in Paris. According to Dr. Variot,² while the infantile population of Paris is about 40,000, the number of children attending the various consultations is not more than about 800 or 900. It is obvious, therefore, that the Gouttes de Lait in Paris are too small to produce an appreciable result.

A still more serious objection is that the period of observation is too short. To estimate the value of any measure for the protection of child life, even if conducted on a large scale, by the mortality occurring in the first few years after its adoption is obviously most untrustworthy, as infantile mortality is highly sensitive to varying meteorological conditions and to the epidemic prevalence of such diseases as whooping cough. As a matter of fact, all the Gouttes de Lait selected by Dr. Peyroux, except those at Fécamp and Grenoble, began their work either just before or during a period of exceptionally hot summers. The following table

¹ Caron, "L'Œuvre des Gouttes de Lait," Havre, 1903.

² Variot, "L'Avenir des Gouttes de Lait," *Archives de Médecine des Enfants*, April, 1903.

shows this clearly for the Goutte de Lait at Havre:¹—

TOWN OF HAVRE.

Year.	Deaths under 1 year per 1,000 Births.	Deaths under 1 year from Diarrhœa per 1,000 Births.	Maximum temperature, June— September.
1891	195	66	20·7° C.
1892	227	75	21·1
1893	220	117	21·4
1894	211	116	19·1
1895	215	128	22·9
1896	188	85	20·9
1897	191	115	21·9
1898	223	125	22·5
Goutte de Lait established January, 1899.			
1899	212	136	24·1
1900	221	136	22·6
1901	175	94·8	24
1902	191	88·4	19

It is interesting to note that the infantile mortality was higher in 1902 than in the previous year, although the mean temperature and the diarrhœa rate were comparatively low. This is explained by a very fatal epidemic of measles at the end of 1902.

Further evidence of the fallacies underlying the method we are now considering is afforded by the figures of some of the British milk depôts, which, unlike the Gouttes de Lait, began operations before or during a period of cold, wet summers. In

¹ Caron, *op. cit.*

Liverpool, for instance, the first depôt was opened in May, 1901, and in the following year a second depôt was established and the work greatly extended. The infantile mortality figures of the city show a great and progressive reduction in 1902-3.

Years.	Deaths under 1 year per 1,000 Births.
1896—1900	188
1901	188
1902	163
1903	151

The Battersea depôt opened in June, 1902, and the infantile mortality figures are as follows:—

Years.	Deaths under 1 year per 1,000 Births.
1897—1901	161·8
1902	136
1903	135

The summers of 1902-3 were, of course, exceptionally cold and wet, and therefore conducive to the relatively low rates of mortality which prevailed in the country generally. How far the reduction in Liverpool and Battersea was due to the weather or to the depôts it is impossible

to say, but there is no reason to doubt that the former was the preponderating condition.

The fallacies which occur when too short a period of observation is taken are more serious than those arising from the small number of children fed from the *depôt*, for though the number actually fed may be small, the educational influence of the *depôt*, which some consider its most important effect, may not be inconsiderable if its operations extend over a fairly long period. It will be noted that at Fécamp and Grenoble, the two oldest of the institutions mentioned by Dr. Peyroux, there was an appreciable reduction in the mortality which appears to be independent of weather conditions. Would it not be possible, then, to draw trustworthy conclusions from the movement of infantile mortality, provided that the *depôt* had been at work for, say, ten years, though only working on a comparatively small scale? In this connection the New York figures are of interest. The Straus Milk Charity was established in 1893 and has since steadily increased its area of operation. Compared with the enormous population of New York, the number of children fed from the fourteen *depôts* may be small, but its educational effect extending over ten years has probably been not inconsiderable. To what extent, then, has the remarkable reduction in the New York infantile mortality in the last decennium been due to the Straus *depôts*? The complexity of this problem is at once apparent from a consideration of

the following chart, which was compiled by Dr. Rowland G. Freeman, Mr. Straus' chief medical adviser.¹

It appears that the Straus Milk Charity was not the only ameliorative influence which came into operation after 1893. Since that date the quality of the milk supplied in the city has improved, sterilization of milk has become general,² many streets have been paved with asphalt, a better system of refuse removal has been introduced, open spaces have been provided, anti-toxin has come into use, the condition of the tenement-houses has been improved, and the St. John's Guild and other similar organizations have been the means of providing sea-trips for many thousands of children in New York during the hot weather in July and August. How is it possible to isolate the Straus depôts from these agencies and measure their influence on the decline in the infantile mortality? It would seem, then, that the method of comparing the mortality in the same town before and after the establishment of

¹ Freeman, "The Reduction in the Infantile Mortality in the City of New York, and the agencies which have been instrumental in bringing it about," *Medical News*, New York, September 5th, 1903.

² Sterilization of milk is now so generally practised in the tenement houses of New York that the investigators of the Rockefeller Institute, an account of whose work is given on pp. 105—108, discovered that, "In the summer of 1902 especially it was rare to find an infant fed on raw milk." This has probably been the chief factor in the decline in the mortality.

the milk depôt may be untrustworthy, even if a fairly long period of observation be taken, unless a searching analysis be made of the local conditions.

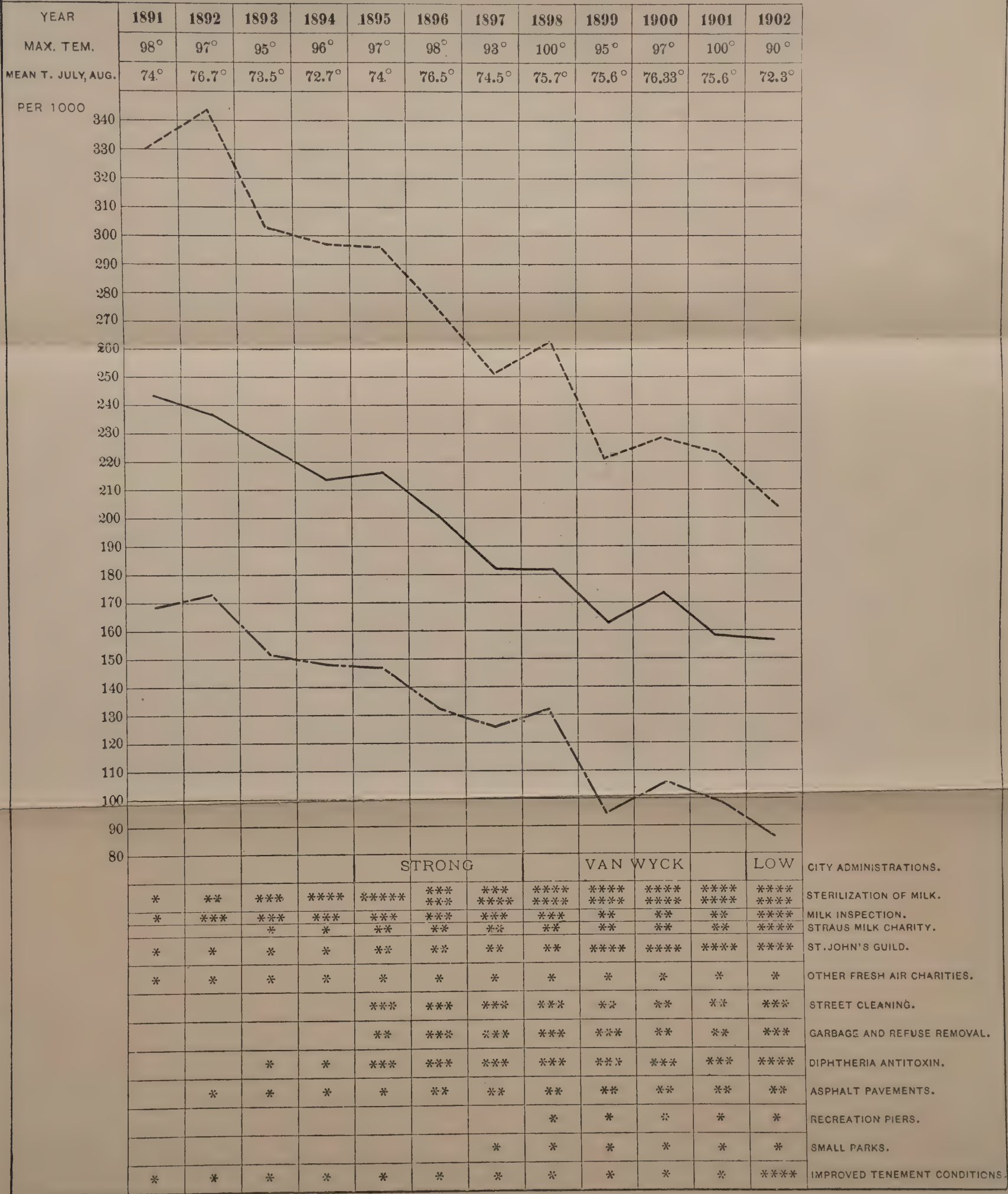
The best way of applying this method, however, is (1) to take a population small enough to be kept under observation, (2) to feed, from a given time, the whole of this population from the depôt, and (3) to compare the mortality before and after the introduction of the depôt milk, care being taken to extend the observations over a sufficiently long period, and to allow for meteorological variations, etc. Probably this could only be done in an institution. Some figures of this kind have been published relating to Mr. Straus' milk supply in New York. The story is best told in Mr. Straus' own words:¹—

“As a mere hint of what might be accomplished by municipal ownership and municipal operation of plants for the pasteurization of the milk supply of cities, the results of the establishment of a plant in the Infant Asylum at Randall's Island, New York City, may be quoted. In 1897 the death-rate amongst the waifs picked up in the streets of New York and taken to the hospital was 44·36, a rate so high as to become a matter of grave concern to those in charge. I asked permission to supply the asylums with all the pasteurized milk they required.—This offer was declined, and the appalling death-rate continued.—Finally, in 1898, I secured permission from President John W. Keller, of the Department of Charities, to instal in this asylum a complete plant for the pasteurization

¹ Nathan Straus, “Why the Distribution of Pasteurized (Sterilized) Milk should be a Function of every Municipality,” New York.

THE DECLINE IN MORTALITY IN NEW YORK OF INFANTS UNDER 1 YEAR AND THE AGENCIES WHICH HAVE CONTRIBUTED TO IT.

———— MORTALITY FROM ALL CAUSES FOR YEAR.
----- MORTALITY FROM ALL CAUSES FOR JUNE, JULY, AUGUST AND SEPT.
- - - - MORTALITY FROM DIARRHOEA FOR JUNE, JULY, AUGUST AND SEPT.



of milk foods. The following statistics, furnished by the Department of Charities, show the result of the first attempt at municipal proprietorship and operation of a milk pasteurizing plant :—

Year.	No. of Children Treated.	No. of Deaths.	Death-rate per cent.
1895	1,216	511	42·02
1896	1,212	474	39·11
1897	1,181	524	44·36

“ The pasteurizing plant was installed in the early part of 1898, and the death-rate immediately dropped as follows : ”—

Year.	No. of Children Treated.	No. of Deaths.	Death-rate per cent.
1898	1,284	255	19·80
1899	1,097	269	24·52
1900	1,084	300	27·68
1901	1,028	186	18·09
1902	820	181	22·07
1903.	542	101	18·63

This appears to be a really valuable statistical result, and it should serve to encourage those who are striving to reform the milk supply.

The third, and for ordinary purposes perhaps the most promising of the purely statistical methods, is to compare the movement of infantile mortality in the district before and after the establishment of the depôt with that in neighbouring districts containing no depôt but in other

respects similar. Paffenholz gives figures compiled on this method for the depôt at Yonkers, N.Y., U.S.A., which was opened in 1895. The figures relate to Yonkers and three other suburbs of New York.¹

Period.	Hoboken 55,000 pop.		Long Island City, 40,000 pop.		Newburgh, 26,000 pop.		Yonkers, 38,000 pop.	
June, July, August and September in each year.	Deaths		Deaths		Deaths		Deaths	
	Under 5 years.	From diarr- hœa.	Under 5 years.	From diarr- hœa.	Under 5 years.	From diarr- hœa.	Under 5 years.	From diarr- hœa.
1892—1895	289	104	225	90	75	30	162	91
1896	352	110	257	115	72	43	135	48
Difference	+63	+6	+32	+25	-3	+13	-27	-43

The period of observation is, however, too short; it would be interesting to know what happened after 1896. And further information is needed as to the prevalence of epidemic disease in the various districts and other local conditions before any conclusions can be drawn from these figures.

It is evident, then, that each of these three statistical methods is beset with fallacies; but it does not follow that a purely statistical method is inapplicable. Where the work of the depôt has

¹ Paffenholz, "Wichtige Aufgaben der öffentlichen und privaten Wohlfahrtspflege auf dem Gebiete des künstlichen Ernährungs des Säuglings."—*Centralblatt f. allgem. Gesundheitspflege*, Bonn, 1902.

been conducted on a sufficiently large scale and for a sufficient length of time, conditions which do not appear to have been fulfilled in the case of any existing institution, it should be possible to trace its influence on the mortality figures provided that the investigations are conducted by persons adequately acquainted with the local conditions.

The best method, however, is to institute an investigation—clinical, pathological and statistical—somewhat on the lines of the enquiry lately conducted by Drs. Park and Holt in New York.¹ The objects of this enquiry were: “(1) To make a comparison of the results of infant feeding in tenements in winter and summer; (2) to determine how far such results were affected by the character of the milk used, especially its original bacterial content, its preparation, and whether it was fed after heating or raw; (3) to see to what extent results were modified by other factors, such as the care the infants received and the surroundings in which they lived.” The clinical observations were made during the summers of 1901—02 and the intervening winter by ten physicians, each of whom had a group of about fifty children under observation for periods of about ten weeks. The children were visited twice a week and their weights taken at regular intervals. No child was ill or suffering from marasmus when the observations

¹ Park and Holt. *Op. cit.*

began. The total number observed was 632; 340 were six months old or under, 265 from seven to twelve months, and 47 a little over twelve months. Many of the infants received breast-feeding at night, and all of course were under regular medical supervision during the period of observation. The statistical results of this enquiry are tabulated below. It should be said that the store milk was in nearly all cases heated in the summer; usually it was raised to nearly boiling point. In the winter in about half the cases some method of partial sterilization was employed. The condensed milk was almost invariably prepared with boiled water.

	Summer Observations.		Winter Observations.	
	Good Results.	Bad Results.	Good Results.	Bad Results.
	Per cent.	Per cent.	Per cent.	Per cent.
Store Milk ...	56	44	96	4
Bottled Milk ...	61	39	94	6
Condensed Milk ...	60	40	92	8
Milk from Central Distributing Stations... ..	81	19	93	7

These figures are not intended to indicate strict numerical differences. There are obvious statistical objections; for instance, it is not stated whether the age-periods were the same in each group. The observers, however, regard them as comparable and as indicating a real and marked difference

between the results with the milk from the central stations, *i.e.*, the Straus depôts and similar institutions, and those obtained with the other forms of feeding. The difference is attributed to the fact that at the milk depôts a certain amount of supervision was exercised over the infants,¹ and some systematic attempt at milk modification was made. "Again, what contributed in no small degree to success with this plan of feeding was that this milk was supplied in separate bottles for each feeding, that the quantity for one feeding was suitable for the child, and that only a proper number of feedings for the twenty-four hours was dispensed at one time. There was not, therefore, the temptation to over-feeding and too frequent feeding which with other methods are so generally practised."

In addition to the statistical reports the physicians were asked to state their own conclusions as to the general problem of infant feeding in tenements. Their opinions founded on their clinical experiences are most suggestive. The unanimous opinion was that the most important factor in securing good results is intelligent care; but as regards the various methods of feeding studied the physicians have no doubt as to the superior advantages of the milk depôts. "Of the methods of feeding now in vogue,

¹ But all the children in this investigation were under some supervision by the physicians making the observations.

that by milk from central distributing stations unquestionably possess the most advantages, in that it secures some constant oversight of the child, and since it furnishes the food in such a form that it leaves the mother least to do, it gives her the smallest opportunity for going wrong. This method of feeding is one which deserves to be much more extensively employed, and might, in the absence of private philanthropy, wisely be undertaken by municipalities, and continued for the four months from May 15th to September 15th."

This testimony of the New York clinicians is perhaps the best evidence in favour of the Infants Milk Dépôt that has yet been published.



GROUP OF MOTHERS AND BABIES IN THE NON-PAYING SECTION OF THE "LAITERIE MATERNELLE," BRUSSELS.

CHAPTER VIII

OBJECTIONS.

IT may now be useful to consider briefly some objections which have been brought against these institutions. In France the Goutte de Lait has been strongly opposed by Professor Pinard and his followers, prominent amongst whom is Dr. Peyroux, on the ground that such institutions tend to encourage artificial feeding at the expense of breast-feeding. So far as the writer is aware no evidence whatever has been brought forward to substantiate the charge. It should be remembered that the institutions against which this most serious accusation is brought are not merely so many centres for the distribution of sterilized milk. The chief feature of the work of the Goutte de Lait is the medical supervision of the children. Each baby is periodically weighed and examined by the medical director of the institution, and the food is carefully regulated to suit the infant's development. It is true that cow's milk is supplied, but only when the supervising doctor is satisfied that breast-feeding cannot be secured. Such are the methods of the Goutte de Lait, and yet, according to M. Pinard, the

Goutte de Lait must be condemned because it substitutes the bottle for the mother's breast! One shrinks from any attempt to conjecture to what depth of the Inferno M. Pinard would consign the British milk dépôts.

The charge of discouraging breast-feeding may be brought with some show of reason against any measures which safeguard, simplify, or cheapen the artificial feeding of infants. It is largely in the interests of the children that efforts are now being made to reform the milk supply. Let us suppose, then, that by some great achievement of organizing capacity pure cow's milk could be sold in our towns for a penny a quart. It might plausibly be maintained that this cheapening of the best substitute for mother's milk would tend to discourage breast-feeding. Of late years many of our municipalities, realizing the close connection between improper infant feeding and infantile mortality, have distributed leaflets containing directions as to the feeding of infants, and in some districts this is supplemented by oral instruction by lady inspectors and health visitors. From a glance at the ordinary advisory leaflet it is apparent that although breast-feeding is strongly recommended the main object of the leaflet is to improve artificial feeding, and the same may be said of the work of the health visitors. The teaching of approved methods of artificial infant feeding to the elder girls in our elementary schools is now warmly recommended as a measure from

which much benefit may be expected. In addition to this wide diffusion of knowledge of the less objectionable methods of artificial feeding, some municipalities have taken more practical steps to help mothers to avoid disaster in bringing up their babies by hand. In some districts attempts have been made to abolish the lethal feeding-bottle with the long rubber tube (an appliance which has been described as an effective modern substitute for the pestilences of the Middle Ages) by placing on the market at a nominal price a feeding-bottle of an approved pattern; and in order to prevent the impoverishment of cow's milk which results from the methods of modification usually practised amongst the poor from their inability to purchase cream, it has been proposed to supply at cost price an appliance which will not only materially simplify home-modification, but will also ensure that the modified milk contains a proper quantity of gravity cream. In other districts a step farther has been taken by the establishment of a supply of specially prepared infants milk. What difference of principle is there between these various methods? If the supply of infants milk at prices varying from eighteen pence to two shillings a week (and with repeated warnings that it is but a poor substitute for mother's milk) be discouraging breast-feeding, may not the same charge be brought against the gratuitous distribution of knowledge which assists mothers to feed their babies by hand, and against the

semi-gratuitous distribution of model feeding-bottles and modifying appliances? And what are we to say of Professor Rotch and the other distinguished American physicians who have so greatly added to the resources of the artificial feeder of infants by substituting, for the rough and haphazard methods of milk modification generally practised, a system which provides a milk of a definite and known chemical composition? Whatever the disadvantages of "percentage feeding" may be, there can be little doubt that it is a great addition to our methods of artificial infant feeding, and that in certain cases it enables cow's milk to be used when no other method of artificial feeding would be of any avail. If percentage feeding were cheapened (as it might be by the establishment of milk-laboratories by philanthropic or by municipal action) and brought into more general use, can we doubt that it might be used to the detriment of breast-feeding? This question is much more complex than it appears at first sight.

The charge of discouraging breast-feeding must not lightly be dismissed. It is a grave accusation and demands serious consideration. Starting from the postulate that mother's milk is immeasurably the best infant food, and that breast-feeding should be continued for at least nine months from birth, we have first to enquire what proportion of infants are breast-fed for so long a period. The most recent observations in this connection are those

of Dr. Newsholme, who took a census of infant feeding in the poorest districts in Brighton in the summers of 1903-04. The number of houses visited was 5,358, and particulars were obtained as to the feeding of 608 infants. The main results of the census may be stated in tabular form as follows¹ :—

Ages of Infants in months.	No. of Infants Fed.			Percentage of Infants Fed.		
	Suckled alone.	Suckled and Artificial Food.	Artificial Food alone.	Suckled alone.	Suckled and Artificial Food.	Artificial Food alone.
0—3	133	16	13	82	10	8
3—6	104	21	40	63	13	24
6—9	90	17	42	61	11	28
9—12	55	26	51	41	20	39
0—9	327	54	95	69	11	20

It appears, then, that amongst the poor in Brighton only 69 per cent. of the infants are fed wholly at the breast for a sufficiently long period, and if a similar census were taken in one of the industrial towns where a large number of women earn their living away from home, there can be no

¹ Newsholme : "Annual Report on the Health of Brighton," 1904. Dr. Newsholme has kindly supplied the writer with an advance copy of the portion of the report in which this subject is discussed.

doubt that the proportion of hand-fed infants would be greater. We want more knowledge on this point, but Dr. Newsholme's figures are sufficient to show that amongst the urban poor at least 30 per cent. of the infants under nine months are wholly or partially fed on artificial foods. Amongst the middle and upper classes the proportion would be greater.

The discontinuance of breast-feeding by mothers who are willing and anxious to suckle is to be attributed largely to unfavourable economic conditions. Even the physical inability to suckle is in many cases due to such conditions. No doctor who has practised amongst the poor can doubt that the semi-starvation of the mother is an important cause of artificial feeding. Bread and tea is the diet on which many a poor mother has to subsist, and it is not surprising to find that in such cases "the milk goes." The more closely the question is investigated the more clearly does it appear that the feeding of the mother is an important factor in the problem of the prevention of infantile mortality.

It has been suggested that breast-feeding would be encouraged if the Factory Act were altered so as to extend the period during which a woman is prohibited from working in a factory or workshop after childbirth, the object being to ensure that the mother shall stay at home and nurse her baby. It is not clear whether steps are to be taken to prevent the mother from working away from home



INFANTS MILK DEPOT YORK.

as a charwoman or in private laundry work, etc. ; but what is clear is that such legislation will make the married woman more dependent on what her husband thinks fit to allow her. It may be argued that if a mother is to be thus restricted in order that she may serve the State by nursing her infant, the State should secure for her the means to perform this work. But it is doubtful whether those who charge the milk depôts with discouraging breast-feeding are prepared to accept the principle of a State subsidy for nursing mothers. The question bristles with difficulties and calls for much more knowledge, much more patient thought, and much more energetic but discriminating action than it is likely to receive.

For the prevention of artificial feeding arising from the selfishness of mothers who are in a position to nurse, but who refuse to do so, we must look to the creation of a more enlightened public opinion. The enormous advantages of breast-feeding are insufficiently appreciated by the public, and it is possible that the ordinary ignorant mother of the middle or upper classes, eager to fulfil her "social duties," really thinks that no harm is being done when she delivers up her baby to the bottle. It is to be feared that this course is sometimes taken on the advice of ignorant or unscrupulous nurses anxious to curry favour with their employers. In the creation of a healthy public opinion on this subject much could be done by the concerted

action of the physician and the minister of religion.

There is no doubt that by organized and well-directed effort breast-feeding could be encouraged and made more general in this country. In France, largely owing to the noble and devoted efforts of M. Budin, much good work is being done in this direction. But the problem is enormously difficult and progress necessarily must be slow, and in the meantime what is to be done with those babies who must either be fed artificially or not at all? Obviously it is our plain duty to see that their artificial feeding shall do them as little harm as possible. While we should do all we can to encourage breast-feeding, it is necessary that the more humble work of improving artificial feeding should not be neglected.

It is well to have a high ideal, but an idealism too lofty to take into account the hard facts of life can be of no practical service. When it is a question of practical measures aiming to secure the welfare of the children, the hundred reached by the lowly but effective process of adding one to one is preferable to the unit missed by "the high man aiming at a million." We must realise that at the present time artificial feeding is in many cases a necessary evil; the most pressing question is whether it shall be well done or badly done—the latter alternative entailing an immense loss of life.

It has been objected to the municipal milk dépôts

“that for a municipality to furnish a sterilized milk supply raises special difficulties as to the function of a municipality, which surely should be to control the milk supply and insist upon its purity rather than to itself trade in a sterilized milk.”¹

It would seem that objections of this nature would apply equally to a municipal supply of water or to the municipal provision of slaughter-houses, both of which measures are wrong if the function of a municipality be only to control private traders. And it is questionable whether it is profitable in this connection to consider very closely the difficulties which may arise as to the precise function of a municipality. In attempting to assess the value of any given administrative measure having for its object the saving of human life, it is surely preferable to regard its effect on the public health as the all-important consideration. The question properly falls within the province of preventive medicine, and there appears to be no necessity to enter the region of political science in search of a determination of the “function of a municipality.”²

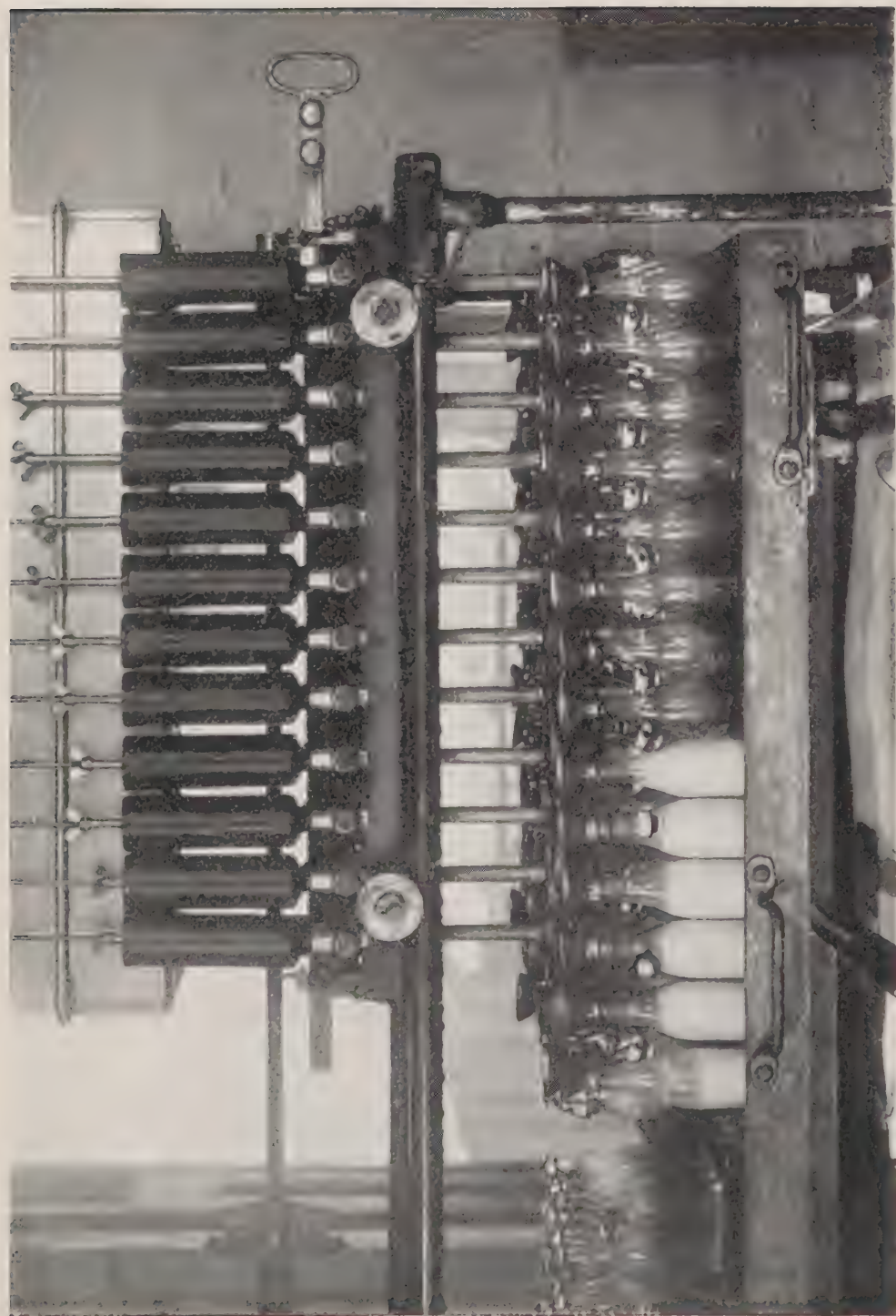
But the controlling and supplying functions are not antagonistic. Liverpool “trades in a sterilized

¹ Swithinbank and Newman, “Milk Bacteriology,” p. 503, 1903.

² It will be noted that the New York physicians engaged in the investigation conducted by Park and Holt came to a different conclusion as to the functions of a municipality in relation to the prevention of infantile mortality.

milk," but Liverpool was one of the first municipalities to take action in the reform of the milk supply. The large towns, however, are at a disadvantage, as practically all their milk comes from the country, and most of it is already contaminated before reaching the town. In the rural districts the regulations for the control of the milk supply are practically inoperative, and as the rural authorities are largely composed of persons directly or indirectly interested in the milk trade, this is hardly a matter for surprise. The ordinary cowkeeper does not readily apprehend new ideas; he inclines to the opinion that what was good enough for his father is good enough for him, and he does not hesitate to express his conviction that the demand for clean milk is nothing more or less than a "doctor's fad." It has been contended that the best way to secure the production of clean milk is to transfer the administration of the orders and regulations relating to milk from the Rural District Councils to the County Councils. It is not easy to see how this measure is going to solve the problem of the milk supply. Some idea of the interest taken by many of the County Councils in public health matters may be gathered from the fact that out of the sixty-two Councils of administrative counties in England and Wales no less than thirty-five Councils have not even appointed a Medical Officer of Health,¹ while in only

¹ Local Government Board Return, May 18th, 1904.



INFANTS MILK DEPOT, LIVERPOOL. BOTTLE-FILLING MACHINE.

sixteen of the remaining twenty-seven counties does that officer devote his whole time to his duties. Few of the great milk-producing counties have appointed a whole-time Medical Officer of Health. To administer efficiently the law relating to milk would require not only a Medical Officer of Health, but also a large staff of inspectors, and, in fact, a well-equipped and highly organised County Public Health Department. Why a County Council should incur this expense for the purpose of supplying the large towns with clean milk is a question which the County Councillors would find considerable difficulty in explaining to their farmer constituents at the next election. If the large towns want clean milk they must not look to outside authorities to get it for them.

The difficulties in the way of securing a clean milk supply have been greatly under-rated. It is not merely a matter of clean, well-constructed cowsheds, any more than aseptic surgery is a matter of clean, well-constructed operating theatres. Aseptic milking, like aseptic surgery, depends on the standard of cleanliness of the operator. The production of clean milk involves the careful grooming (at 4, or even 2 a.m.) of a very dirty animal and the observance of strict cleanliness of person and utensils by the employees handling the milk. Any observant person who has watched the ordinary process of milking, and noted the standard of cleanliness of cows and milkers, must surely agree that if manure and

other filth is to be kept out of milk it will be necessary either to effect something like a revolution in the personal habits of the employees in the milk trade, or to substitute persons of a higher social standing who may be relied upon to maintain the necessary standard of cleanliness, and observe a reasonable moderation in the matter of expectoration in the absence of external compulsion.

But assuming the difficulties in the way of clean milk production by private enterprise to be solved, at what price will the milk be sold? Dr. Chapin, the founder of the "Certified Milk" movement in America, appears to regard a rise in price of the milk supplied to the poor in the American cities as inevitable, and the attempt to improve "grocery milk," therefore, as "almost hopeless."

"Legislation cannot compel a farmer to produce his milk at a loss, and the population that consumes "grocery milk" would vote out of office authorities that prohibited its sale or advanced its cost" . . . "Farmers cannot be expected to take additional care of their milk without extra compensation. Higher prices to the farmer is the solution of the milk problem, and the dealer should also have extra compensation for any additional labour and care on his part."¹

Reformers have been "voted out of office" elsewhere than in New York City. If the movement

¹ Chapin, "The Theory and Practice of Infant Feeding," 1903.



INFANTS MILK DEPOT, ROCHESTER, U.S.A.—DISTRIBUTING CENTRE AT A POLICE STATION.

for the reform of the milk supply raises the price of milk so as to take it beyond the reach of the poor the milk reformers will have done more harm than good.

Let it be granted, however, that clean milk at ordinary prices is brought to the door of the consumer, is the problem of the prevention of contamination solved? By no means, for as we have already seen, in diarrhœa the contamination takes place largely, if not chiefly, in the home of the consumer. One of the chief advantages of the milk depôt is that the milk is supplied in such a way as to reduce the possibility of contamination within the home to a minimum. But here another objection is raised. It is contended that home contamination is best prevented by educating mothers and the elder school-girls in the methods of artificial infant feeding and in the care of infants generally.¹ Provided that the curriculum includes instruction in the enormous advantages of breast-feeding—a point somewhat neglected by English writers—this statement cannot be contested, but it must be borne in mind that ignorance is not the only factor in improper feeding. The mother in a poor household has often to contend against such conditions as bad housing, semi-starvation and chronic ill-health, and is often quite unable to secure the conditions necessary

¹ Swithinbank and Newman, *op. cit.* See also Niven "Annual Report on the Health of Manchester," 1902.

for successful infant feeding. There is scope for work other than education. As a matter of fact, however, there is no antagonism between the milk depôt and education; on the contrary, the depôt is in itself an important educational influence. It is as Variot urges, "*Une école d'alimentation.*" But the diseases due to ignorance are far from being limited to those depending on imperfect infant feeding. If the public were adequately instructed as to the conditions giving rise to disease and the proper preventive measures, mortality tables would present a very different appearance. Tuberculosis would dwindle into insignificance, a compulsory vaccination law would be entirely unnecessary, and small-pox epidemics would become "*portions and parcels of the dreadful Past.*" But pending the arrival of that period of enlightenment a compulsory vaccination law has its uses, even in educated Germany. At the present time it is unsafe to rely on educational methods alone for the prevention of any disease.

We may conclude, then, that the real objects in connection with infant feeding (other than the encouragement of breast-feeding) at which the sanitary authority should aim are (1) clean milk, and (2) the education of present and future mothers, but that the attainment of these objects is a matter of very great difficulty; and if it be admitted that pending such attainment the infants milk depôts fulfil a useful function, we



INFANTS MILK DEPOT, ROCHESTER, U.S.A.—DISTRIBUTING CENTRE AT A BAKER'S SHOP.

must also conclude that their period of usefulness will certainly be protracted.

It may be said that municipal milk depôts have received the approval of so high an authority as Sir Richard Douglas Powell, who in his lecture to the Congress of the Sanitary Institute at Glasgow, in July, 1904, spoke as follows:—"There can be no doubt that scientifically conducted dairy farms on a large scale, with urban depôts for the reception and dispensing of pure milk in clean bottles at a fair price to the poor, would pay, and would be a most laudable employment of the municipal enterprise that is often devoted to matters of much less urgent public interest and importance. Apart from the primary benefit of affording a pure milk supply at a fair price, the object lesson to mothers and families in food cleanliness would be beyond price."¹

Another objection brought against the English depôts is that inadequate provision is made for the medical supervision of the infants. It is urged that regular weighing and inspection by a medical practitioner should be insisted on in all cases, as in some of the Gouttes de Lait. Dr. Niven has the following valuable suggestions on this point²:—

1. The milk must be obtained from farms kept under inspection by the Corporation, and preferably managed by the Corporation.

¹ *Journal of the Sanitary Institute*, August, 1904.

² *Op. cit.*

2. When modified and sterilized it should be sold at paying prices, except to persons willing to submit to certain rules.
3. These rules should include systematic weighing of the infant, inspection of the house, and supervision by officers of the Corporation.
4. A written undertaking must be given to keep up the feeding of the child for a period of not less than three months with milk obtained from the dépôt; to give the infant no other food whatever, and if it is desired to give up the method of feeding to lodge at the Health Office a statement of the reasons why the mother desires to be released from her undertaking.
5. The person assisted must also undertake to carry out the other instructions given by the visiting officer of the Corporation in the management of the infant.
6. The Corporation to provide adequate means of supervising the application of the milk supplied, and to keep a record of the condition of the children supplied with modified and sterilized milk.
7. Where the milk is supplied at a paying price no supervision should be maintained or agreement entered into.

Dr. Niven's fourth condition is, however, too stringent, and could not be carried out in practice. It is important to avoid anything like undue restriction, otherwise a prejudice against the dépôt is raised. It does not follow that methods which are practicable in France will succeed in this country, where there is a strong feeling against official regimentation. And it is important that any steps in this direction should be taken with the cordial co-operation of the local medical



INFANTS MILK DEPOT, ROCHESTER, U.S.A.—WASHING THE BOTTLES.

practitioners ; otherwise success will certainly not attend the dépôt.

In November, 1904, a dépôt managed more on the lines of the French institutions was opened by the Finsbury Social Workers' Association at the initiative of Dr. George Newman, Medical Officer of Health of Finsbury. Children are only fed from this dépôt on the condition that they are brought up once a fortnight to be weighed and examined by one of the members of the medical committee of the dépôt. To this rule there is no exception. The home of each child is visited once a week by one of the lady workers of the Association, who makes a written report of each visit to the medical committee. It is not intended to feed more than fifty children from this dépôt, the object being to exercise an *individual* supervision over a comparatively small number rather than to distribute infants' milk without strict supervision to a large number of infants. It should be said that the milk supplied at this dépôt is produced under exceptionally good conditions. It is drawn from a herd of specially selected, tuberculin tested cows, and strict cleanliness is observed in milking. The milk is pasteurized and bottled on the farm before being sent to London. Although somewhat restricted in its action, this dépôt is managed on admirable lines, and it is to be hoped that it will meet with the success it deserves.

Another objection deserves consideration. It is

contended that when a municipality undertakes a supply of milk, the sources of the supply should be subject to strict supervision and control, and that only milk of a high degree of bacteriological purity should be used. This is, of course, indisputable, and it must be admitted that there is room for improvement in this respect. In the Straus dépôts in New York, however, the milk is certified by the Milk Commission, and is of a high standard of purity. In some of the Gouttes de Lait great care is exercised to obtain clean milk. In nearly all the British dépôts the source of the supply is supervised, and the contractors are under strict regulations.

But it must be admitted that it is easier to lay down regulations than to ensure their fulfilment, and the writer entirely agrees with Dr. Niven's suggestion that the farm from which the milk for a municipal milk dépôt is drawn should be a municipal institution under the direct management of the responsible officers of the sanitary authority. In this connection it is interesting to note the experience of the city of Rochester, N.Y., U.S.A. In 1897 the municipality began a supply of milk on methods similar to those afterwards adopted in this country. At first the milk was sterilized or pasteurized, but in 1899 the following plan was adopted:—

“A central station at which the milk is prepared is organized each season on a farm outside the city, where a trained nurse and assistants have full control



INFANTS MILK DEPOT, ROCHESTER, U.S.A.

(a) Portable room in which the milk is bottled and packed in ice; (b) bottle washing tent; (c) tent in which the bottles and utensils are sterilized; (d) tent of manageress.

of the cows, utensils, bottles, &c., and where all of the milk work is carried on in a portable milk laboratory. Everything coming in contact with the milk is thoroughly sterilized in steam sterilizers. The milk itself is not subjected to any pasteurizing or sterilizing process. Sterilizing and pasteurizing are only an open invitation to the milkman to be careless in the production and handling of milk.

"At the milk station on the farm the milk is taken from clean, well-fed, tested cattle into sterile cans, which are carried to the barn in sterile cheesecloth bags. Just before milking the cows' udders are washed. A sterilized cheesecloth fly cover is placed over the cow, the first portion of the milk being rejected. So soon as the cans are filled they are immediately covered by a layer of cheesecloth held in position by a rubber band. The cans of milk thus covered are immediately taken from the barn into the laboratory, about 200 yards away, where the milk is properly diluted, sweetened, and turned off into sterile nursing bottles of various sizes of the Siebert type. The bottles are corked with sterile rubber corks, placed in racks, covered with cracked ice, and immediately transferred to the city for use. Of the cleanliness of milk prepared in this way, forty-three daily samples were found to average not more than 14,000 bacteria per cubic centimetre, while the city milk for the same period approximated 235,000 bacteria per cubic centimetre."¹

These methods are far in advance of anything which has been done by the British municipalities, and it is much to be hoped that they will be introduced into this country. Not only would

¹ "The Influence of the Municipal Milk Supply on the Deaths of Young Children," Dr. Goler, Health Officer, Rochester, N.Y., U.S.A., *New York State Journal of Medicine*, December, 1903.

the necessity of any heating process be removed, but a practical object lesson could be given in methods of clean milk production which would give an immense impetus to the movement for the reform of the milk supply now on foot in this country.



INFANT'S MILK DEPOT, ROCHESTER, U.S.A.—PACKING THE MILK BOTTLES IN ICE BEFORE
SENDING THEM TO THE CITY.

APPENDIX.

THE COST OF AN INFANTS MILK DEPÔT.

THE initial cost of the machinery and appliances in six of the British depôts is set out as follows:—

	£
Battersea	150
Dundee	200
Glasgow	650
Leith	150
Liverpool	640
St. Helens	235

To this, of course, must be added the cost of erecting or altering premises for the work; this will vary with the kind of premises available. In Battersea it was found necessary to carry out considerable alterations, and the cost was £250, the total initial cost of the depôt being £400.

The following is a list of the chief appliances (with cost of each) in use in the Battersea depôt at the present time:—

	£	s.	d.
Sterilizing chamber, with two trolleys on rails, fitted with safety valve, steam-gauge, and two thermometers (as shown opposite p. 76)	65	0	0
Boiler, with injector	23	0	0
Cold storage chamber	42	0	0

I.M.

K

	£	s.	d.
Galvanized iron cooling tank, with fittings	9	8	0
Bottle-filler (as shown opposite p. 78)	2	0	0
Automatic bottle - filler, with four syphons	4	10	0
Electric motor, with two revolving brushes for cleansing bottles ...	6	10	0
Milk strainer	0	17	6
Weighing machine	1	0	0
Wire baskets (1) to hold nine bottles, per dozen	0	13	0
Wire baskets (2) to hold six bottles, per dozen	0	10	0
Graduated 7 oz. bottles, fitted with stamped porcelain stoppers complete, per gross	1	0	0
Rubber teats, per gross	1	2	6

The method of supplying milk in separate bottles, each bottle containing only enough for one meal, involves considerable labour in filling and washing bottles, for each child receives from six to nine bottles per day. A considerable amount of breakage is also inevitable. If the milk is supplied at the low prices charged at the British depôts it is practically impossible to avoid a loss. The loss varies in the different districts; in Leith it is as low as six shillings a week, whereas in Liverpool the loss for the year 1903 was about £2,000. The balance-sheet of the St. Helens depôt, which is the oldest in this country, is given on p. 131.¹

Some municipalities, however, have not limited their good work in this connection to the expensive system of supplying infants milk in separate bottles. In Bradford and Ashton-under-Lyne the municipal milk depôts supply unmodified sterilized milk at ordinary

¹ Drew Harris, "Annual Report on the Health of St Helens," 1903.

prices in pint bottles for the older children, who also stand much in need of good milk. Where this system is adopted, a profit should be made which should go far to neutralize the loss on the infants milk.¹

The table on p. 132 shows the expenditure and income of the Liverpool depôts, which are the largest in this country.² It should be noted that the expenditure includes considerable sums for machinery, furniture and building alterations, which should be charged to capital account in estimating the net working loss.

ST. HELENS.

EXPENDITURE AND INCOME FOR YEARS 1900 TO 1904.

Current Expenditure.	1900—1901.	1901—1902.	1902—1903.	1903—1904.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wages for Attendance...	115 11 5	119 2 2	116 7 9	108 13 11
Milk	272 9 2	185 5 16	185 13 4	123 19 2
Rent of House and Rates	18 0 0	18 0 0	21 15 0	22 3 11
Sugar	8 6 6	14 2 6	16 6 6	9 2 0
Fuel, Gas and Water ...	9 4 0	9 19 10	15 4 8	12 2 8
Sundries	21 13 5	22 19 6	22 16 1	25 11 7
Renewal of Bottles, &c.	25 18 8	33 6 5	62 1 2	24 14 2
	471 3 2	402 16 3	440 4 6	326 7 5
Income from sale of Milk	328 9 5	245 16 3	208 16 8	139 13 8
Amount falling on Rates	142 13 7	157 0 0	231 7 10	186 13 9

¹ For a further discussion of this subject, see Dr. Lawson Dodd's book, "The Problem of the Milk Supply." The Bradford depôt supplies a considerable quantity of milk wholesale to the municipal hospitals, and cream and eggs are supplied at the depôt. The sale of eggs now brings in about two pounds a week.

² Hope, "Annual Report on the Health of the City of Liverpool," 1903.

LIVERPOOL.

EXPENDITURE AND INCOME FOR YEARS 1900 TO 1903.

	1900.	1901.	1902.	1903.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Wages and clothing	277 11 9	856 4 3	1,093 9 9
Rents ...	10 3 6	69 2 0	141 18 1	128 4 1
Rates and Taxes	20 13 4	46 15 6	65 9 0
Water Rent	39 10 4	100 17 7	79 16 6
Gas	3 12 0	18 6 10	30 8 7
Coal	1 19 0	6 2 4	19 11 1
Printing and Stationery	7 3 6	12 18 9	12 13 6
Disbursements	3 10 0	10 10 0	29 0 10
Cleaning Premises, Windows, &c....	...	1 14 0	...	27 12 4
Travelling and Inspec- tion Expenses...	1 2 2	303 19 10	1,427 2 10	1,604 12 1
Stores (Milk, &c.)	3 8 0	6 16 0	13 16 10
Telephone Rent	333 8 3	84 16 5	9 9 11
Furniture and Fittings...	...	101 13 10	673 14 1	120 0 10
Machinery ...	114 4 3	425 19 0	459 16 8	645 9 0
Bottles, Stoppers, &c....	...	275 12 0	278 8 5	74 0 10
Building Repairs, Altera- tions, &c.	5 12 0	179 16 0	267 13 3
Horsing Vans, and Hire of Float	27 16 7	10 5 9
Electric Light Installa- tion	2 18 7	2 9 3
Insurance...	25 0 0
Medical Attendance— Scalding Case
	125 9 11	1,874 8 10	4,334 18 11	4,259 3 5
Sale of Milk	518 0 2	1,534 13 7	2,230 11 1

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